INDIANAPOLIS PUBLIC LIBRARY DEC 15 1900

AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION

VOLUME 23 — NEW YORK AND LONDON — NUMBER 50

Published at 218 William St., New York,
Every Thursday by the

American Machinist Press.

[INCORPORATED.]

JOHN A. HILL, President and Treasurer.
A. LEIGHTON DONNELL, Sec'y.

Also published at 34 Norfolk St., Strand, London, W. C.,
Every Saturday.

FRED J. MILLER, Editor.

FRANK RICHARDS,
F. A. HALSEY,
EDWARD P. BUFFET,
} Associate Editors.

Representatives of Business Department.

ANGUS BALLARD, for New England.
JOHN MCGHIE, for Middle States.
WILLIAM R. WALLIS, for the West.

Correspondence on mechanical subjects solicited. Name and address must always be given—not necessarily for publication.

Address all business communications to the American Machinist Press. Matter for reading columns may be addressed to the Editor.

Subscribers can have address changed at will. Give old and new addresses. Date on wrapper denotes end of month in which subscription expires.

Subscription Price:

$3 per year in advance, postage paid, in North America.
$4 per year in foreign countries, postage prepaid.
No back numbers beyond current year.
For sale by newsdealers, generally.

AMERICAN MACHINIST CO., Ltd.,
34 Norfolk St., Strand, London, W. C.

ADPHE. JANSSENS, Ingr.,
16 Place de la République, Paris.
10 A Boulevard Barthélemy, Bruxelles.

V. LOWENER,
Copenhagen,
Representative for Denmark, Norway and Sweden.

GUSTAV DIECHMANN & SOHN,
Neue Promenade 4, Berlin,
Representatives for Germany, Austria and Holland.

J. F. VILLALTA,
Puertaferrisa, 7-9 Barcelona,
Representative for Spain.

Entered at New York P. O. as second-class mail matter.

Cable address, "MACHINIST," N. Y.
Lieber's and A B C Codes.

The Mechanical Engineers.

We in this issue present our report of the recent annual meeting, in this city, of the American Society of Mechanical Engineers. It tells of a meeting in most respects highly successful and satisfactory. The society is growing rapidly in membership and strength, and, as is now the story year after year, the record of attendance was greatly in advance of that of any previous meeting. We believe too, that those whose privilege it was to attend the meeting found it a most pleasant and enjoyable and generally also a most profitable one. Calling for special mention was the original and unique feature of the meeting that one of its principal sessions was held in a fine lecture hall of one of the noblest of America's great institutions of learning, and that the entire membership in attendance were practically given the freedom of the buildings with their already splendid and costly mechanical equipment and their great collections in the various departments of science.

The principal, though by no means the sole, function of the society is aimed to be accomplished through its regularly appointed meetings. At these meetings are expected to be presented carefully prepared papers upon current topics in mechanical engineering. These papers tell of the latest and the best that is being accomplished, and suggest and stimulate to continually advancing mechanical achievement. The discussions which the papers elicit are perhaps on the whole not less valuable than the papers themselves. The published transactions of the society, which are little more than the records of the semi-annual meetings, are certainly respectable, and contain matter which is frequently referred to or quoted as authoritative upon the topics with which it has to do. It would seem to be natural and proper to expect that with the continued growth of the society in membership and general prestige there should be a commensurate advance in the transactions which are its product. This does not necessarily mean that they should be more voluminous. There should be every encouragement for the best men to contribute of their best; there should be no hindrances and discouragements, and no consequent deterioration of result.

The society is quite given to the study of the efficiencies of steam engines, pumps, and other mechanical apparatus, and very properly and profitably; it might not be amiss to study in the same way the efficiency of the society itself. It is fair to assume, as we do, that the character of the membership is fully sustained, and that the new acquisitions are of as good average quality as the old. This then, we might say, means a considerable increase in boiler capacity, an increase, with sustained or enhanced efficiency, of results produced. The increase at the boiler, of course, at once suggests the necessity of an increase in the capacity of the working cylinder, and this we regret to say has not been secured. The room in which the discussions of the society are held is wofully inadequate for the present requirements. However fortunate the society may be in possessing, for all the weeks of the year but one, a local habitation so satisfactory, it is distinctly unfortunate for the one week. If it had no home, and if it were necessary to hire some hall for the meeting, it is very certain that more adequate accommodations would be secured.

So much for the cylinder. The society also very much needs a cut-off. It is not certain whether it should be automatic or not, but it should be one that will work with certainty and precision. The cut-off mechanism has indeed been provided in the construction of the machine. The rules defining the rights of speakers in the discussion of papers are sufficiently clear and precise, if they were only attached to the running gear. At the meeting held at Columbia University a cylinder of sufficient capacity was provided, but the cut-off was out of order, and in fact did not seem to be working at all. The society, with the working capacity that it has, is capable of doing more and better work, and nothing, we think, can at present be suggested in the line of improvement more promising than in the two particulars here suggested.

We incline to the opinion that it would be a good thing to attach the cut-off mechanism to each session by reading from the desk the rules of the society relating to the manner of the presentation of papers and of discussion upon them. We think the rules are good ones and should be adhered to at least closely enough to remind members that such rules exist. As the cut-off now works, or rather, as it fails to work, members who may have come a considerable distance, more especially to hear read and discussed or to take part in the discussion of a paper toward the end of the list are deprived of attaining their object because the cut-off does not work at all in the earlier sessions, and in the later ones operates erratically and arbitrarily in a vain effort to regain time forever lost.

We quoted a few weeks ago from a paper by G. W. Dickie, of San Francisco, in which he said that British shipbuilders had the advantage of American ones in point of cost of material, whereas the previous impression had been that this was not the case. We note that President James J. Hill, of the Great Northern Railroad, stated in an address before the Bankers' Club, of Chicago, the evening of the 8th inst., that he had gone into costs quite thoroughly and had found that he could contract to have vessels built here at a much lower figure than on the Clyde, and the British journals are continually

warning their readers of the impending deluge of American steel selling there at prices which it will be difficult if not impossible for British steel makers to meet.

A correspondent sends a clipping from a Waterbury daily paper having an article called "A Hero of the Taku Forts." A picture of the "hero" is given standing alongside a shell (whether a Chinese or American shell we cannot quite make out) but the story is to the effect that this man made a hero of himself by fishing out from the boiler before it had a chance to explode a shell which had been maliciously thrown by some Chinese gunner so that it penetrated a boiler in one of the American naval vessels. From this we suppose we are to conclude that the navy has developed a type of boiler, which, when it is penetrated by, say, a 6-inch shell, kindly waits and does nothing about it until a sailor man has time to drop a bent pin or something of that kind down into the hole and fish the shell out again. If such a boiler has been devised it would be very interesting to have the particulars about it.

German-American Trade Relations.

In the annual report of Consul-General Mason from Berlin to the State Department he reviews the symptoms and causes of the present industrial depression in Germany with associated topics. He notes the uneasiness felt in Germany at the growing dependence of that country upon the United States for food stuffs. He recognizes the German overproduction in cement, iron tubing and various other manufactured products, the stoppage of export trade to China and the South African states, and the absorption of capital by investments in commercial and industrial enterprises. "There are invested," he writes, "in the 150 German stock companies which manufacture electrical machinery and equipment more than $200,000,000, or nearly four times the amount of such investments in 1896. To this may be added 450,000,000 marks, or more than $100,000,000, invested in electric tramways, lighting and power plants during the same period. The average dividend paid by the electric manufacturing companies in 1899 was 9.3 per cent., but nothing could prevail against the downward tendency of industrial investments, and electrical stocks have shared in the general drop which has taken place during the past six months. As a measure of this decline there is herewith given the market values of the stocks of several leading companies on the first of January, June and October, 1900, respectively:

Companies—	Jan. 1.	June 1.	Oct. 1.
Siemens & Halske.	178	171	159
Schuckert & Bo.	227.6	213.4	185.4
Helios.	167.75	155.6	127
Union Electrical Co.	171.3	137.5	134
Berlin Electrical Works.	216.5	204.8	192.5

Mr. Mason concludes with an argument for the establishment of better commercial relations between Germany and this country. "The time is ripe," he says, "for a calm, deliberate and scientific revision of the present obsolete and imperfect treaties between the republic and the empire—a broad, intelligent adaptation of their relations in all that pertains to reciprocal trade, naturalized citizenship and other vexed and irritating questions, to the new and vastly enlarged positions which both countries have won since the present treaties were framed. Here, as elsewhere, the United States is frankly recognized as Germany's most richly endowed, most aggressive and most formidable rival. On the other hand, the empire is, after Great Britain, our best customer, and anything which checks the prosperity of her people will diminish to that extent their ability to maintain the reciprocal trade which is now so heavily in favor of the United States. In the commercial competition between the two countries all natural advantages—cheap and superior ores, coal, lumber, cotton and food materials—are and will remain strongly on the side of our country. To these Germany can oppose her higher technical and mercantile education, cheaper and more tractable labor and a merchant marine capable of carrying her products to every market on the globe. Rivals thus endowed and equipped can surely afford to sink all petty jealousies and resentments and meet each other in a spirit of manly emulation and mutual respect."

Legal Notes.

BY WILLIAM MARSTON SEABURY.

A DEFECTIVE HYDRAULIC CYLINDER.

The machinery of the Union Compress & Storage Company, of Clarksdale, Miss., being out of order, this company entered into a contract with the Livermore Foundry & Machine Company, of Memphis, Tenn., to make the necessary repairs, etc., and to place its plant in a proper condition.

By the contract the Livermore Foundry & Machine Company agreed to furnish the necessary labor and materials for the repairs on the Compress machinery, to wit: "To furnish one new cylinder head, drilled and fitted as per old; to furnish one new piston head, fitted with packing rings and springs, with additional metal added; to furnish one new low-pressure hydraulic cylinder; new special bolts for steam cylinder head and rear end of both hydraulic cylinders; to repair cracked steam cylinder in best possible manner, and make tight; to re-line high-pressure cylinder with seamless drawn tube, so as to be true and smooth. . . . The Livermore Foundry & Machine Company agrees to complete the above mentioned repairs and press ready for service within the period of fifty-five days from the date of the contract."

A much longer period than fifty-five days elapsed before the work was completed. Three tests were made, in all, of the machinery, and on the first test it was discovered that there were defects in the head of the new hydraulic cylinder. On the second test these defects were found still to exist. After some additional repairs the machinery was again set in motion. After about 400 bales of cotton had been compressed, an explosion took place which inflicted serious damage to the plant itself and severely wounded several employees of the Compress Company.

Upon examination it appeared that the head of the low-pressure steam cylinder, as well as that of the low-pressure hydraulic cylinder, had blown out, and other parts of the machinery had been seriously injured.

The Union Storage & Compress Company brought suit against the Livermore Foundry & Machine Company to recover $1,000 paid by the Compress Company on account of the contract, together with damages for the injuries to the plant by the explosion, and for the rental value of the compress during the period of enforced idleness after the accident.

The plaintiff contended that the accident resulted from the fact that the defendant had unskillfully cast the cylinder, and that its head was of inferior material, and so imperfectly made that it would not stand the strain put upon it in the careful operation of the machinery. Among other things, it appeared from the evidence that after the casting had been done, the manager of the Livermore Company found what he supposed were shallow sand holes in the head of the cylinder, which he said did not weaken it, but gave it an unfinished appearance, and for this reason he placed over this head a solid brass plate which cost $150. To fix this plate over this head some forty-five holes were bored into the upper rim of the cylinder, which the manager did not think weakened the cylinder to any extent. When the tests were made, jets of water burst out all around the head where it was claimed the imperfections were.

There was much other evidence tending to support the plaintiff's contention, and the jury rendered a verdict in its favor, allowing it to recover the $1,000 paid on the contract, $3,500 for the injury caused the plant by the explosion, and $3,000 for loss of the rental value of the compress. The defendants appealed to the Supreme Court of Tennessee, but the judgment was affirmed. (58 S. W. R. 270.)

EMPLOYEE ORDERED TO TEST PROPER WORKING OF A MACHINE.

Catherine Eaves was employed by the Atlantic Novelty Manufacturing Company to operate a machine in their establishment, and while so employed received injuries, to recover damages for which she instituted suit in the Superior Court of Suffolk County, Massachusetts.

The superintendent of the defendant or-

dered the plaintiff to start the machine at which she was engaged. The superintendent had reason to know that the plaintiff might understand the order as a command to see if the machine was all right by resuming work. The plaintiff so understood it, and was justified in so understanding it, and while starting the machine her hand was thrown from its usual place by the unusual shaking of the machine, and was injured.

The lower court rendered judgment for the plaintiff, which, on appeal, was affirmed by the Supreme Judicial Court of Massachusetts, the appellate court holding that, under the circumstances, the superintendent was negligent when he gave the order. (57 N. E. R. 669.)

Committee of Experts on Pneumatic Tubes.

The Postmaster-General has appointed a committee of experts to consider matters relating to the use of pneumatic tubes for the transmission of mail. The members of the committee are: Theodore C. Search, Philadelphia; R. H. Thurston, Ithaca, N. Y.; S. C. Mead, New York; Lyman E. Cooley, Chicago; Alfred B. Fry, New York; William T. Manning, Baltimore, and Frederick A. Halsey, New York.

Foundry Rehearsals.

The current issue of "Foundry" has an account of the works of the Westinghouse Machine Company, of Pittsburgh, from which we infer that it is a regular feature of this company's work to have what they call a "rehearsal" previous to the pouring of a very large casting. In this rehearsal all the men who are to take part in the pouring go through the precise motions that will be required when the casting is to be poured. The same ladles are used and are handled by the same men and in the same manner, and everything is done as though iron were being poured; the evident advantage of this being that when the actual pouring takes place, the men are then doing precisely what they have done before in precisely the same way, so that there is much less liability of unforeseen difficulties and of things going wrong.

Examination for Draftsman.

The United States Civil Service Commission will hold examinations February 5, 6 and 7, 1901, for the position of draftsman on marine engines and machinery in the lighthouse service, Treasury Department.

At the works of the Plymouth Refrigerator Company, Sheboygan, Wis., a cat lately jumped into the flywheel twelve feet in diameter and making 87 turns a minute. It was 2½ hours before the engine could be stopped, when the cat was still alive, although somewhat lame.

Commercial Review.

NEW YORK, Saturday, December 8.

One of the most interesting announcements of the week is that the Electric Vehicle Company, having offices in this city, has by a stock exchange acquired all the outstanding capital stock of the Riker Electric Vehicle Company, of Elizabethport, N. J. The Riker Company is one of the oldest automobile companies and the Electric Vehicle Company is a powerful interest which controls the Columbia and Electric Vehicle Company, the Columbia Automobile Company and the New Haven Carriage Company. George H. Day, formerly first vice-president of the Electric Vehicle Company, has been elected to presidency of the same. Mr. Day is president of the Electric Storage Battery Company also, but it is denied that a merger of this concern with the Electric Vehicle Company is intended. The Electric Vehicle Company, with the manufacturing interests it now controls, is getting to have somewhat the aspect of a "trust" in its line, though with widespread competition in electric carriages any idea of monopoly would be absurd.

Reports have been afloat in the last few days that the Cramp Ship and Engine Building Company, of Philadelphia, had passed, or was likely to pass, into the control of Vickers' Sons & Maxim, the well-known English firm. While these reports have been more or less directly denied, it seems to be a fact that some negotiations to such an end between those two concerns have taken place. The acquisition of the Midvale Steel Company was also said to be contemplated.

Following are a few brief reports by authorities on the steam-engine trade which are rather encouraging, especially in so quiet a month as December:

From a prominent engine and engineering firm: "Business is very good for this season of the year. The fact that it is not falling off is equivalent to a relative improvement since the tendency of the engine trade at this season is to slump off. Prices are well maintained."

From a well-known engineering firm: "Contracts are being closed up since the election in a very satisfactory maner; in fact, business is doing all that we expected of it. Some of the engine builders who cut prices a few months ago are now stiffening up again, which is shown less in dollars and cents than in length of deliveries, for retarded deliveries we regard as equivalent to higher prices. It is getting to be difficult to obtain an engine of over 300 horse-power, whether high speed or Corliss, in less than eight months. The demand that we notice particularly at present is for street-railway equipments. Factory outfits are in steady requirement."

From the office of one of the largest engine builders: "There is more inquiry now than there was a month or two before election."

Engine builders are looking forward to two important jobs in London, England—both of them underground railway equipments. One of these is that of the London Metropolitan District Underground Railway, on which, as we have already stated, generator manufacturers have been p tting in bids. The contracts were not awarded December 1, as it was reported they would be, but that was the date bids were to be in, and the awards will probably be made with British deliberation. At least one American engine company is interested in the results. The Metropolitan is a road already in existence, but C. T. Yerkes, the Chicago railway magnate, is leading a project to install a new underground road in London which, it is said, will be carried out on an American scale and according to American ideas. The plans for Mr. Yerkes' road have not progressed as far as the Metropolitan's.

A contract has recently been closed with the E. P. Allis Company to furnish an engine and generator equipment for the new United States mint at Sixteenth and Spring Garden streets, Philadelphia. There will be four tandem compound non-condensing engines of 300, 300, 235 and 125 horse-power, respectively, direct-connected to Crocker-Wheeler dynamos. The steam will be furnished by Babcock & Wilcox

MACHINERY, MACHINES, AND PARTS OF—	OCTOBER— 1899 Number.	OCTOBER— 1899 Dollars.	OCTOBER— 1900 Number.	OCTOBER— 1900 Dollars.	TEN MONTHS ENDING OCTOBER— 1898 Number.	TEN MONTHS ENDING OCTOBER— 1898 Dollars.	TEN MONTHS ENDING OCTOBER— 1899 Number.	TEN MONTHS ENDING OCTOBER— 1899 Dollars.	TEN MONTHS ENDING OCTOBER— 1900 Number.	TEN MONTHS ENDING OCTOBER— 1900 Dollars.
Cash Registers	....	95,334	965	68,934	....	*	....	*305,567	....	661,891
Electrical	....	363,773	....	567,610	....	1,939,474	....	2,454,510	....	4,555,015
Laundry Machines	....	28,568	....	35,417	....	*	....	*116,833	....	411,882
Metal-working	....	527,156	....	460,235	....	4,742,488	....	5,522,864	....	5,546,607
Printing Presses, and parts of	....	137,350	....	81,960	....	662,491	....	788,087	....	1,066,322
Pumps and Pumping Machinery	....	175,303	....	219,452	....	1,809,167	....	2,466,014	....	2,370,952
Sewing Machines, and parts of	....	369,505	....	403,391	....	2,620,196	....	3,261,399	....	3,859,825
Shoe Machinery	....	116,377	....	62,849	....	784,415	....	792,938	....	892,964
Steam Engines, and parts of—										
Fire	....	....	1	1,500	7	6,588	3	13,713	11	[a] 24,078
Locomotive	31	280,398	35	309,279	513	4,663,849	434	4,272,850	381	3,925,976
Stationary	71	34,287	112	64,926	438	309,206	715	387,757	1123	678,925
Boilers and parts of Engines	....	119,125	....	155,989	....	1,007,576	....	1,136,286	....	1,613,099
Typewriting Machines, & parts of	....	202,453	....	267,361	....	1,714,325	....	2,918,011	....	2,262,228
All other Machinery, and parts of	....	1,809,671	....	2,394,121	....	12,797,211	....	15,935,015	....	20,000,052

* Not separately stated prior to July, 1899.

UNITED STATES OFFICIAL STATISTICS OF MACHINERY EXPORTS, INCLUDING OCTOBER, 1900.

boilers, which were purchased separately. There were about twenty bidders on the engine and dynamo plant and the Allis Company's bid was the highest of the lot, being 20 per cent. above the next highest competitor's and more than double the lowest.

In contrast with the wide range of bids shown on the Mint engine contract is the closeness of figures recently made on an electric-lighting plant for the city of Detroit, Mich. We learn from the Northern Electrical Manufacturing Company, of Madison, Wis., that this contract has been awarded to it, Northern and Stanley apparatus being called for therein. The plant is to be one of the most complete and modern ones in the country. The Northern Company's bid was $35,865, while of the other two competitors one bid only $9.05 and the other only $166 higher than the amount stated. The variation was so small that it is said the commissioners considered it negligible. From this closeness of bids it is argued that the electrical machinery manufacturers are making more careful estimates and doing less guesswork than formerly.

Some interest attaches to the disposition of the exhibits at the Paris Exposition. All the compressors and drills which the Rand Drill Company exhibited have been sold. The large compound air compressor which supplied compressed air to all the American pneumatic appliances shown at Vincennes has been bought by the firm J. & A. Niclausse, makers of the Niclausse boilers, who will use it for driving pneumatic tools in their large works.

A new selling house for American machine tools and fine tools was opened up not long since in Liege, Belgium, by A. Engelmann & Cie. Mr. Engelmann was for four years the Belgian representative of Schuchardt & Schütte. The show rooms of the new concern are ample and well situated in the city which is the center of Belgium industry. The firm reports large and continuous sales. United States Consul Alfred A. Winslow at Liege has paid a visit to the new house.

A correspondent of the London "Daily Mail" sends to it from Calcutta, India, the following: "The Port Commissioners recently invited tenders for locomotives. The lowest English tender quoted £1,544 for each locomotive, and wanted nine months to complete the order. The lowest American tender quoted £1,260, and asked for six months. The latter was accepted, subject to the approval of the government."

CINCINNATI REPORT.

While inactivity continues among machine and small tool men, the local industrial field as a whole may be said to show up encouragingly. For instance, a large department of the new shops recently built in North Fairmount by the Lunkenheimer Company is to be devoted to the manufacture of automobiles on an extensive scale. The company expects to be in running order in three or four months. The Lunkenheimer Company is at present far behind with orders. The bulk of their largest business in brass valves and fittings comes from the big shipbuilders and the government navy yards at Mare Island, League Island, Brooklyn, Newport News and other points.

The reorganization of the Marshall & Huschart Machinery Company, of Chicago, was an interesting topic of conversation among machine-tool men, a large number of whom are represented by the Chicago house. The United States Cast Iron Pipe and Foundry Company, manufacturers of heavy castings of all kinds, reports business excellent in that line. A recent large order is for a 44,500-pound casting for the E. P. Allis Company to go in the equipment of the Manhattan Elevated Railroad at New York. The manufacturers of electrical-power machinery report business increasing steadily. The Triumph Electric Company has just closed two big orders for motors and generators to go to New York and Philadelphia. An order for a 200-kilowatt belted generator is from the Laclede Gas Company, of St. Louis, for a power circuit. In electrical machinery lines manufacturers note a hardening tendency in prices with material advancing slightly. It would seem that the disastrous cutting in prices of the past few months had quite recently suffered an appreciable relapse. There promises to be a lot of business hereabouts in the spring for manufacturers of street-railroad material. No fewer than a dozen inter-urban lines are projected and some of them already progressed far enough along to become factors of future business.

CHICAGO MACHINERY MARKET.

Some Western representatives of electrical equipment makers say much business is being held over until after the new year opens. Others report trade fairly active. There is large amount of inquiry abroad, and many estimates are requested for new installations. Previous buyers are making additions to their power, and a fair portion of the current trade consists also of substitutions of electricity for other forms of power. One of the inquirers which has delayed purchase until next year is the Derby Lead Company, of Elgin, Mo., which has asked for bids for two 600 kilowatt generators and a lot of hoists. The E. P. Allis Company, of Milwaukee, have inquired for a 600-kilowatt generator and Schwarzchild & Sulzberger, packers, who are erecting a plant at Chicago, have been in the market for an electric-power equipment of about 700 horse-power.

A novel installation will be that of the Wellston Portland Cement Company, Wellston, Ohio, which has just purchased from the Sprague Electric Company a large direct-current plant, consisting of a generator of 750 horse-power with motors of the same aggregate capacity, and ranging from 12 to 100 horse-power. Cement plants have heretofore used alternating current apparatus, as it was claimed that cement dust destroyed the commutators of the direct-motor system. But people interested in the Wellston Portland Cement Company have for the past five years operated plants by direct-current motors, and they say that if the motors are given a little attention the commutators cause no trouble. Among other orders recently secured by the Sprague Electric Company are those for a complete equipment, consisting of twenty-five motors, for the Dallas (Tex.) "News"; twenty-six motors ranging from 2 to 10 horse-power, for the tinware stamping plant of the Gueder & Peschke Manufacturing Company, Milwaukee, and three 75-kilowatt engine type generators for the new Chicago plant of the Otis Elevator Company, which will be operated wholly by electricity.

Kohler Bros. have sold to the Chicago "Tribune" for the equipment of the new newspaper building soon to be erected, electrical generators of about 700 horse-power and motors aggregating 575 horse-power for operating the ten presses of the company.

The small trade for electrical power at Chicago shows more animation than at any time this year. The blighting effect of the prolonged strike in the building trade is fading away and inquiries for small motors are numerous.

Quotations.

NEW YORK, Monday, Dec. 10, 1900.

Iron—American Pig, tidewater delivery:—

Pennsylvania Irons:	
No. 1 X foundry	$17 00 @ $17 50
No. 2 X foundry	16 00 @ 16 50
No. 2 plain	15 00 @ 15 50
Gray forge	14 50 @ 15 00
Alabama Irons:	
No. 1 foundry, or soft	15 50 @ 16 00
No. 2 foundry, or soft	14 75 @ 15 25
No. 3 foundry	14 00 @ 14 50
Foundry forge, or No. 4	13 50 @ 14 00

Bar Iron—Base sizes—For good refined brands on dock, 1.50 @ 1.60c. upward, and for same from store, 1.75 @ 1.90c.

Tool Steel—Base sizes—Good standard quality, 7 @ 8c.; extra grades, 10 @ 14c.; special grades, 16c. and upward.

Machinery Steel — Base sizes — From store, 1.70 @ 2c.

Cold Rolled Steel Shafting—Base sizes—From store, 2.50 @ 2.60c.

Copper—Lake Superior, ingot in carloads, 17c.; electrolytic, 16⅝c.; casting, 16½c.

Pig Tin—27½ @ 27¾c., for 5 and 10-ton lots, f. o. b.

Lead—For wholesale lots, 4⅜c., with .02½ @ .05c. extra for carloads.

Spelter—Prime Western, 4.25 @ 4.30c., New York delivery.

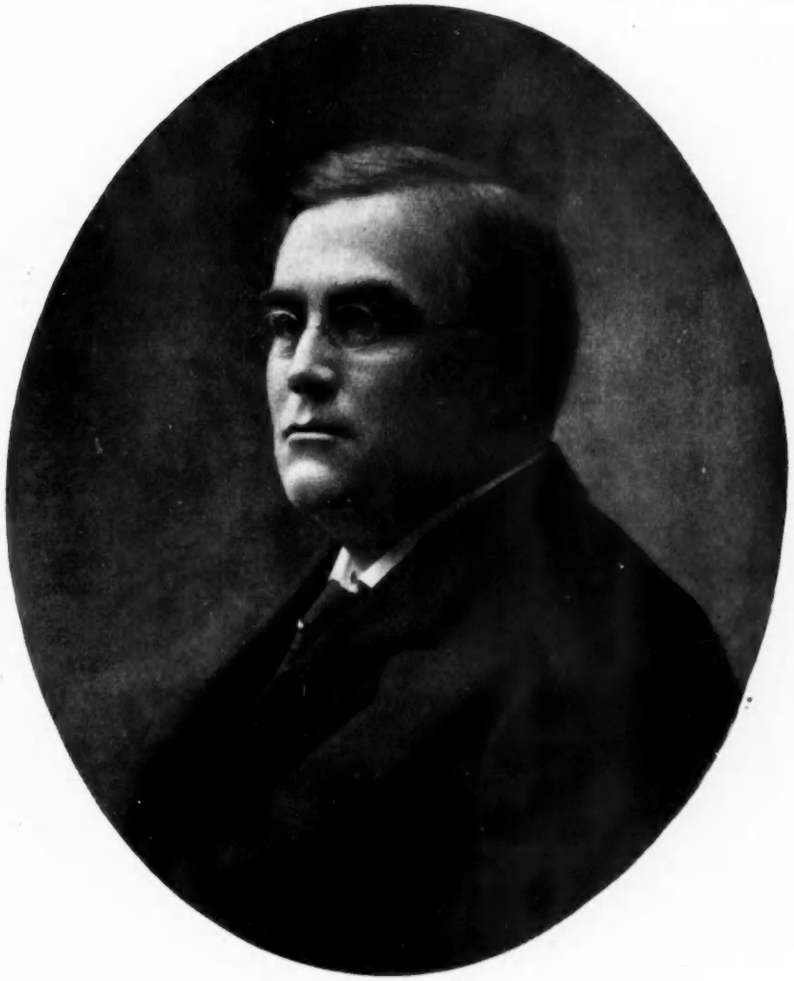
Lard Oil—Prime City, 65c. in 1 to 5 barrels and about 1c. less on large quantities.

S. T. Wellman, President American Society of Mechanical Engineers.

The newly elected president of the American Society of Mechanical Engineers, S. T. Wellman, of Cleveland, Ohio, was born in Wareham, Mass., February 5, 1847. When he was four years old, his father, who was a skilled workman in the works of the Tremont Nail Company, moved to Nashua, N. H., and entered the employ of the Nashua Iron Company, of which works he was a few months later appointed superintendent, and occupied that position for about twenty-seven years. His son, the subject of this sketch, was educated in the common schools at Nashua, one year's time being spent at the High School, besides which he had one year's schooling at the Norwich University, at Norwich, Vt., from 1862 to 1863. Most of his schooling was in the iron works and the machine shop. He served one year as an apprentice in the machine shops of Messrs. Gage, Warner & Whitney, at Nashua, and then went into the civil war, serving one year (1864 to 1865) in the First New Hampshire Heavy Artillery.

After his discharge from the army he was engaged for about two years in the works of the Nashua Iron Company, in various capacities, and at the end of that time was serving as a draftsman and engineer, and built the first Siemens gas regenerative heating furnace which was put into operation in the United States. A few weeks after the drawings had been received, Messrs. Siemens sent an engineer, Mr. J. T. Potts, from England to build the furnace, but upon his arrival at the works in Nashua he was very much surprised to find the furnace finished and ready for work. He was so impressed with the work which Mr. Wellman had done that, after the furnace was started, he made Mr. Wellman an offer to assist him in the erection and starting of other Siemens furnaces in the various works in America, an offer which was accepted. The American agents of the Siemens patents at the time of Mr. Wellman's engagement were Messrs. Tuttle, Gaffield & Co., of Boston, but soon after they sold out their business to Messrs. Richmond, Potts & Loring, with which firm Mr. Wellman was employed for nearly three years. Most of the time he was in their employ was spent at Pittsburgh, where he built and started crucible steel melting furnaces at the works of Messrs. Anderson, Cook & Co.; Singer, Nimick & Co., and a pair of regenerative gas puddling furnaces at the Eagle Iron Works.

When he first went to Pittsburgh in connection with this work, he made up his mind that he would miss no opportunity to learn all there was to be learned as to the manufacture of steel, and he spent all the time he could spare in studying the different operations and storing the information so gained away for future use. Leaving the employ of Messrs. Richmond, Potts & Loring, in 1869, he was employed by the late C. P. Haughian, president of the Chrome Steel Works, of Brooklyn, N. Y., to build for them a Siemens regenerative crucible steel melting furnace. This furnace was built and started, and was so successful that it led to Mr. Wellman's engagement by the late Ralph Crooker, at that time superintendent of the Bay State Iron Company, in Boston, to design and build for that company a furnace for melting steel in the open hearth. The only data and experience from which to build this furnace were gained in the building of a small experimental furnace by Cooper, Hewitt & Co., of Trenton, N. J., who had bought the Martin patents for America and built a small experimental furnace as a test.



S. T. WELLMAN, PRESIDENT A. S. M. E.

The furnace at the Bay State Works was the first open-hearth furnace in the United States to make steel on a commercial scale, and it was successful from the start, continuing in operation for many years. This furnace had a very novel casting arrangement. No ladle was used, but the steel was tapped direct from the furnace through a fore-hearth into the molds, which stood on a turntable in front of the furnace, the stream being regulated by a fireclay covered stopper in exactly the same manner as is practiced in all steel works with a ladle. This fore-hearth has lately been applied, with great success, to the large 50-ton furnaces at the works of the Tennessee Coal, Iron & Railroad Company, at Ensley, Ala.

From the Bay State Iron Works, Mr. Wellman went back to the works of the Nashua Iron Company, where he held the position of engineer and assistant superintendent from 1870 to 1873, his father still being superintendent. During that time he designed and constructed an open-hearth steel plant, three-high plate mill, and a bar mill for rolling merchant iron. In the fall of 1873 he had a very tempting offer to leave the works of the Nashua Iron Company to build a new steel works at Cleveland, Ohio. After going there and looking the ground over, he concluded to accept the position, and in September of 1873 moved with his family to Cleveland, where he was engaged by the Otis Steel and Iron Company to design and build their new works. They started on a new piece of ground and built an open-hearth steel works, a plate mill, and a large and small bar rolling mill. At his suggestion, during the building of the works and for two or three years afterward, the late Alexander L. Holley was

engaged as consulting engineer. Mr. Wellman was entirely responsible for the designing of the works, and the whole management mechanically and metallurgically, was in his hands for sixteen years. The very high reputation of the steel turned out by this works while under Mr. Wellman's management, is well known, and it is a familiar fact that during the latter part of his connection with the Otis Company, the most that any of its competitors was known to claim, was that their steel was "equal to Otis steel." It was acknowledged as the standard for that class of metal.

Early in the spring of 1886, Mr. Wellman rebuilt one of the furnaces at the Otis works, putting in a basic bottom which was made of magnesite imported from the Carl Spaeter works at Coblenz. This furnace was operated for only a few months, but during that time they made quite a large amount of basic steel which was the first ever made in this country. Owing to the limited capacity of the Otis works and the great demand for their regular product of acid steel, the basic process was discontinued, and the experiments which they had made were kept a secret. He, however, was very much impressed with this process, and from that time prophesied that the basic open-hearth steel would soon supersede the acid steel and would in time entirely replace the acid Bessemer process; and to-day nearly all of the open-hearth steel in this country is made by the basic process, the method of manufacturing it being almost precisely the same as that followed by him at the time referred to.

He severed his connection with the Otis Company, and a few months after leaving them became consulting engineer for the Illinois Steel Company, and designed the open-hearth steel works and plate mill now running at the South Chicago works of that company. The following year he became interested in a company which bought the old works of the Chester Rolling Mills Company in Chester, Pa., he becoming president of the company. This was an unfortunate move for him, but possibly a good experience. Added to the difficult problem of remodeling an old works was the harder one of running it at a profit on a rapidly-declining market. In addition to the other troubles, there was a want of harmony among the stockholders, which culminated in the stronger party, who also held the mortgage of the company, forcing it into bankruptcy.

Soon after this, Mr. Wellman moved back to Cleveland, and in company with his brother, Charles H. Wellman, and John W. Seaver, organized the Wellman-Seaver Engineering Company. This company has been very successful, and has been employed as engineers and contractors, mostly in connection with steel works, all over the world; the greater part of its work has been done in the United States, but a great deal has also been done for England, Germany, Spain, Russia, France, and also for a new government steel works in Japan.

Mr. Wellman has taken out a great many patents, the most successful and best known being the Wellman hydraulic crane and the Wellman open-hearth charging machine. The latter machine has no doubt done more to lower the cost of open-hearth steel making than any other invention since the Siemens furnace was invented, the direct saving to the users of the machine in the United States for the year 1890 amounting to not less than one million dollars, and indirectly to more than twice that amount. The Wellman gas producer is also well known, and many hundreds of them are in use all over the United States. A novelty in the way of open-hearth steel melting furnaces is the rolling open-hearth furnaces. These have been built of very large size. What is believed to be the first furnace ever built of 50 tons capacity was of this type, and was built at the works of the Illinois Steel Company.

Mr. Wellman has been connected with several other companies. The Solid Steel Company, of Alliance, Ohio, a very successful works for the manufacture of steel castings, since sold to the American Steel Casting Company, was of his inception, and he was for many years a director and its largest stockholder. He was also a director and stockholder for many years in the Amercian Wire Company, of Cleveland. Besides being a member of the American Society of Mechanical Engineers, which society he joined in 1881, and of which he was one of the managers in 1885-88 and vice president in 1896-98, he is a member of the American Society of Civil Engineers, American Institute of Mining Engineers, the British Iron and Steel Institute, the British Institution of Mechanical Engineers, and the Verein Deutscher Eisen-hutten-leute.

Trade-Marks in Germany.

A German law in regard to trade-marks, which looks like a flagrantly unjust one, and which all Americans who do business there ought to know about, is the subject of an official communication by Consul-General Frank H. Mason.

"It appears necessary," he writes, "to recall the attention of American exporters to a very peculiar provision of the German law for the registration of trade-marks, which is not infrequently used to the great and unjust disadvantage of Americans and other foreigners. Under the German statute, any person may register and secure right to any name or other device used as a trade-mark which has not previously been registered here by some other firm or person. In other words, the officials before whom the application is brought make no inquiry to ascertain whether the applicant has ever used the proposed trade-mark or has any right to it, but simply look over the record to ascertain whether it has been registered in Germany. If not, it is admitted to registration without further inquiry or delay. The readiness with which such a practice can be abused is apparent. When, several years ago, American bicycles began to be imported into Germany, certain persons interested in blocking the trade got the trade-marks of two or three makers registered in their own names, and either obliged the legitimate American owners of the trade-marks to buy them off—in other words, to pay a species of blackmail—or to change the marks on all bicycles exported to Germany. In a recent case, the trade-mark on a special brand of American preserved fruit was registered here by an outsider, so that the real owner had to buy from the usurper the right to use his own trade-mark in this country. This abuse has become so notorious that a leading patent attorney of Berlin, writing in a recent number of the 'Technische Rundschau,' says of the law that its effect is to legalize and facilitate the theft of a trade-mark. The obvious suggestion to all American exporters is that before exporting or seeking to export to Germany any kind of merchandise covered by a well-known name, whether registered in the United States as a trade-mark or not, they should have such name or trade-mark duly registered in this country, where all such rights are carefully protected and prosecutions for infringements easy and effective."

The "Berliner Tageblatt," commenting on the above report regards it as not entirely just. "All that American merchants have to do who export to Germany," says that paper, "is to get their trade-marks registered here at an expense of 30 marks in each case, which is precisely what German merchants do to protect themselves against fraudulent practices." The "Tageblatt" adds a hope that the projected German-American commercial treaty will also provide better mutual protection for patents and trade-marks.

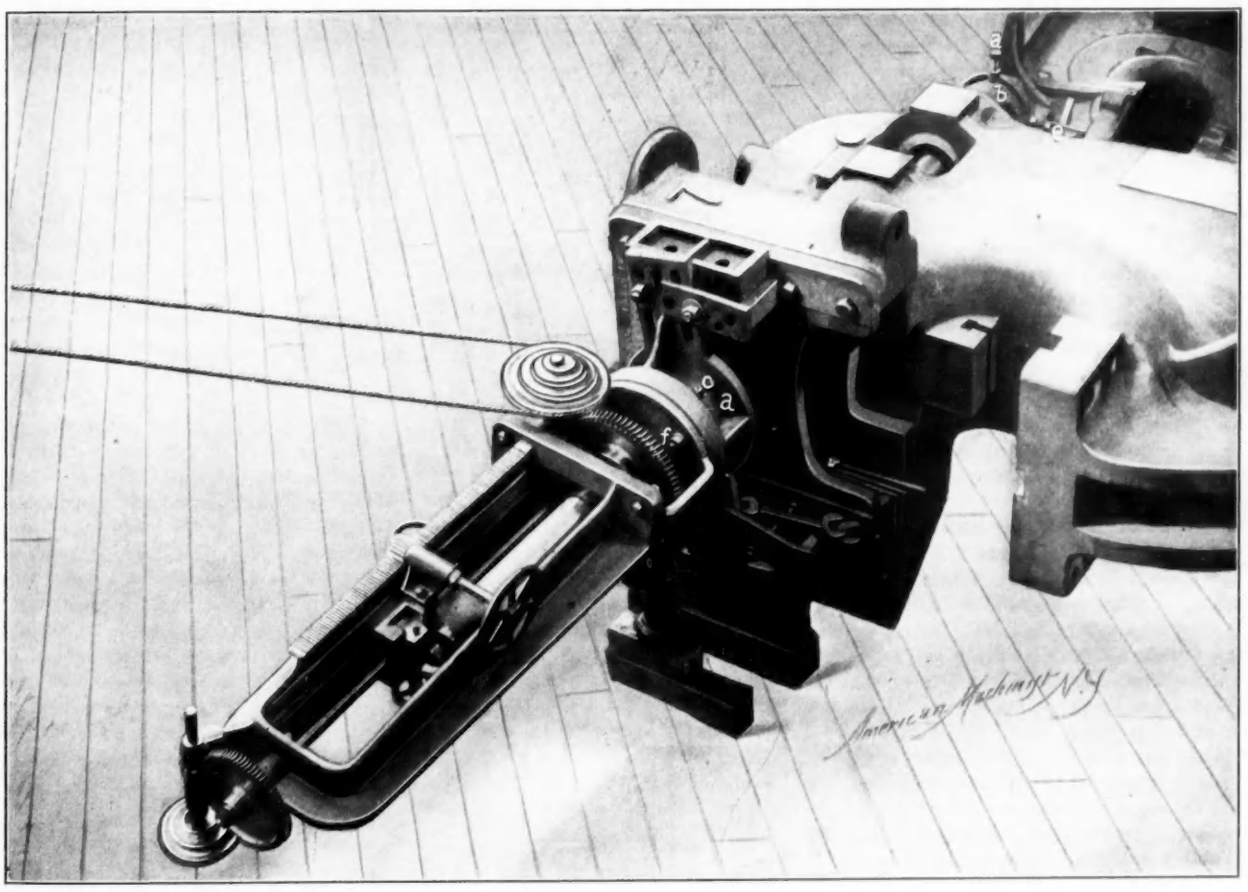
A Portable Boring Bar.

The accompanying illustration is from a photograph for which we are indebted to the courtesy of the Hilles & Jones Company, of Wilmington, Del. It shows an excellent portable boring bar, which is in almost daily use in the works of that company, the piece of work being operated on by it being the frame of a heavy punch press for which the bearings for the main shaft are being bored.

Ordinary sizes of these machines have their bearings bored on elevating table horizontal spindle boring machines, but the larger sizes are beyond the capacity of such machines, and this bar is used instead. Considering the massive character of the frame castings, which must be handled and adjusted if the work is to be done on stationary machines, it is doubtful if the work could be done on them with stationary machines as econom-

ically as with this bar, which, as will be seen, is fitted with the necessary means for quick and easy adjustment, and for stripping it of extra weight while the adjustment is being made.

The housing seen in the foreground does not carry the bar, but is carried by it, the housing and worm driving gear being removed when the bar is being adjusted. The point of separation is back of the flange just beyond the driving worm. The flanged sleeve beyond this—marked *a*—is bolted roughly in position by the means shown and a somewhat similar sleeve, *b*, is likewise bolted to the opposite end of the piece of work. These sleeves are each fitted with four adjusting screws, of which



A PORTABLE BORING BAR.

one belonging to *a* can be seen at *c* and two belonging to *b* can be seen at *d e*. These screws carry the bearings of the bar, which are also sleeves, but of a size to permit considerable lateral adjustment in sleeves *a* and *b*. The sleeves *a* and *b*, being roughly located, the bearing sleeves and bar are then put in place and by the screws the bar is easily adjusted to the exact position required—the housing in front being in the meantime off of the bar. The bar being adjusted, this housing and worm driving gear are slid over its end and secured to the sleeve *a* by the bolts, of which one appears in the picture at *f*. These bolts have holes of a size to permit more or less lateral displacement of the flanges on the housing and supporting sleeve, and usually there is, of course, more or less such displacement, but the housing and the working parts carried by the bar are necessarily in correct relation with the bar when the housing is bolted in place.

The drive and feed are by a rope from one of the familiar counterweighted countershafts, the feed being by a screw, split nut and worm connected by a second rope with the first worm shaft. The split nut, when open, permits quick hand traverse of the bar by the hand-wheel on top of the housing.

Several sizes of bar are fitted to this arrangement, the largest being five inches in diameter. Punch and shear frames having bearings up to twelve inches in diameter are bored by it.

The Premium Plan Idea in a Zinc Smelter.

Mr. H. V. Forest, of Thayer, Kansas, sends us the following clipping from a recent number of the Topeka State Journal with the remark that "the system is based upon a local conception of the broader idea upon which the 'premium plan' is founded." It will be seen that the premium payments are based upon more careful handling of the materials rather than upon the handling of increased amounts, but inasmuch as this more careful handling gives a larger output of zinc, the result is essentially the same. We can see no reason why the idea should not be extended to the handling of larger quantities of ore, though possibly the quantity handled is fixed by conditions beyond the control of the workmen, in which case the suggested extension would not be feasible. We may add that we know of two cases in which the premium idea has been applied with entire success to mining operations—a certain output of ore by each gang being settled upon as a day's work, and the miners being then paid a premium on any excess above this amount. We think our readers will see that the premium idea has a much wider field of operation than that to which we devote ourselves.

"Iola, Kan., November 24.—It has become known here that the Lanyon Zinc Company has for several months had in operation a plan which is in effect a sharing of profits with its employees. It came about in this way: When the new management took possession of the works a careful system of checks and balances was devised by which the exact amount of spelter derived from a given quantity of ore was known. It was found that this quantity lacked a good deal of being as much as the assays showed it ought to be, and it seemed probable that at least a

part of this loss was due to careless handling of the ore at some point in the smelting process. The management, therefore, hit upon the idea of offering the workmen a premium for more careful work. Taking the average amount of metal which had been obtained through a considerable period as a basis, the company offered the operatives a certain percentage of the value of all the metal obtained in excess of the usual amount.

"The first month this plan went into effect it cost the company $900 to pay the premiums. The next month the men began to see that it was paying them to do good work, and they captured $1,000 in premiums, and during October the company distributed nearly $3,000 among the men over and above their regular wages, the premium checks running all the way from a few cents to $45 to each man.

"This plan does not impose any harder work upon the employees, it simply puts a premium on more careful work. And that it is exceedingly popular among the workmen is shown by the loyalty of the men to the company and by the candor and promptmness with which a man who shows signs of carelessness is "jacked up" by some fellow workman. The ore passes through hundreds of hands and the efficiency or indifference of one man may cut down the premium checks of every other man on the works. The result is that the work in the three smelters of the Lanyon Zinc Company is done with a snap and precision that suggests military discipline."

Notes on Hoisting Drums.

BY C. F. BLAKE.

In considering the design of a drum, the diameter is usually determined by the requirements of speed of hoist, load to be lifted and the life of the rope; while the length is determined, after the diameter is decided upon, by the required capacity of the drum in feet of rope, two wraps of rope being usually assumed to stay always on the drum unwound. This greatly relieves the strain of the rope directly upon the point of attachment to the drum. Having determined upon the diameter and length of a drum, the thickness is the next consideration. The rope being wound upon the drum under tension creates a pressure normal to the surface, and of equal intensity per unit area over the whole drum. We may consider one wrap of the rope in the same manner as we do a band shrunk upon a cylinder. Several authorities have discussed that question, the formula given here being from Prof. Forrest R. Jones' "Machine Design—Part 2," the letters being altered to suit the present writing:

$$2T = p\,d\,D$$

$$p = \frac{2T}{d\,D} \qquad (1)$$

in which

T = tension in rope,

D = diameter of drum,

p = pressure in pounds per square inch on drum surface,

d = diameter of rope.

We have also the formula usually used for the thickness of cylinders:

$$t = \frac{2 f_c t}{D} \qquad (2)$$

in which

f_c = allowable compressive fiber strain per square inch in material of drum,

t = thickness of drum.

Equating values of p in 1 and 2 we have:

$$\frac{2T}{d\,D} = \frac{2 f_c t}{D}$$

$$t = \frac{T}{f_c\, d} \qquad (3)$$

The thickness of the drum, then, is directly proportional* to the tension in the ropes, and indirectly proportional to the product of the fiber strain by the diameter of the rope.

For very light loads the formula will give results impractical in the foundry, and the thickness must be made greater to facilitate casting.

The ends of a drum may be made solid webs, or with arms. The best form of arm for drums is a T-section, as shown in Fig. 4. When the rope leads from one end, as at b, Fig. 1, the bending moment on each arm is approximately:

$$= \frac{T(R-r)}{n}$$

where

R = radius of drum + radius of rope,

r = radius of hub,

n = number of arms.

The rib on the arm has so little effect upon the strength of the arm to resist the bending moment as to be negligible, and we may take the moment of resistance of the arm as

$$\frac{M^2 N f}{6}$$

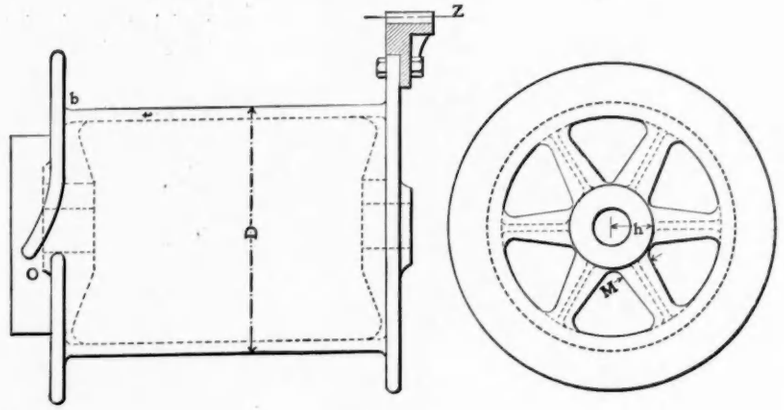


Fig. 1

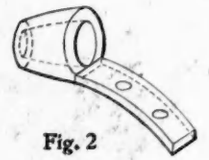


Fig. 4

Fig. 2

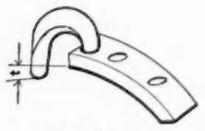


Fig. 3

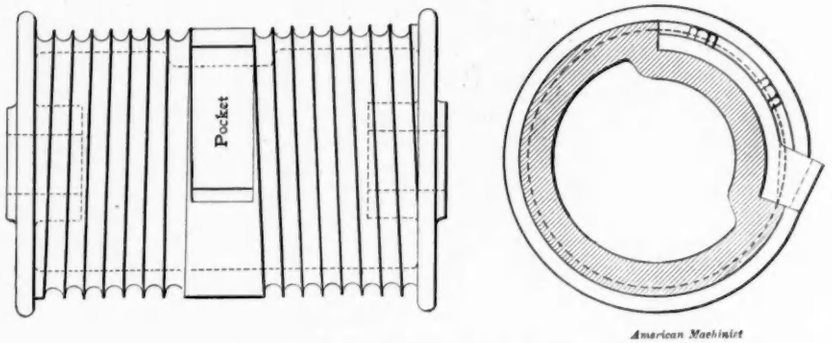


FIG. 5. THE DESIGN OF HOISTING DRUMS.

*This formula leads to excessive thickness of drum in cases where the rope wraps around the drum in several successive layers. We once knew of a large mine hoist drum of this description, the thickness of which was thus calculated, and the result was a thickness beyond all reason and all practice. The case is analogous to that of a built-up gun. Each additional layer of rope compresses the inner layers, and thus relieves the strain upon them and the strain which they impose on the drum. The same action must also, to a certain degree, accompany the successive turns of a single wrap.—Ed.

Thus we have

$$\frac{T(R-r)}{n} = \frac{M^2 N f}{6}$$

or

$$M = \sqrt{\frac{6\,T(R-r)}{N n f}}$$

The following table from Kent's handbook shows the influence the diameter of the drum has upon the life of the rope:

Diam. of Rope in Inches.	Diam. of Drum in Feet, Showing Percentages in Life of Rope for Various Diameters.						
	100%	90%	80%	75%	60%	50%	25%
1⅛	9	7·5	6·5	6	5	4·5	3·75
1	8	7	6	5·5	4·5	4	3·5
⅞	7·5	6·75	5·75	5	4·25	3·5	3
¾	5·5	4·5	4	3·75	3·25	3	2·25
⅝	4·5	4	3·75	3·25	3	2·5	2

The rope should be attached to the drum in a manner to admit of easy removal when worn out and needing replacing, and should have no sharp bends at the point of attachment. Fig. 2 shows a drum strap, in which the rope is passed through the small end, the strands being spread and babbited in. Fig. 3 shows a strap, the finger of which is intended to pass through a thimble spliced into one end of the rope and through the shell of the drum.

It often happens that two ropes are required to be wound upon a drum. Fig. 5 shows a drum scored right and left from the center. The drum strap is made to hold two ropes, and a pocket is made in the drum to receive it, as shown. The drum shown in Fig. 1 has an opening *O* in one flange, the drum strap being bolted to the flange and the rope passing through the opening. At *Z*, Fig. 1, is shown a frequent practice in securing the driving gear to the flange of the drum. This relieves the shaft of all torsional strain, and often the drum hubs are brass bushed and the drum runs loose on the shaft. A good rule for the thickness of such bushings is:

$$t = .05\,d + \tfrac{1}{8} \text{ inch,}$$

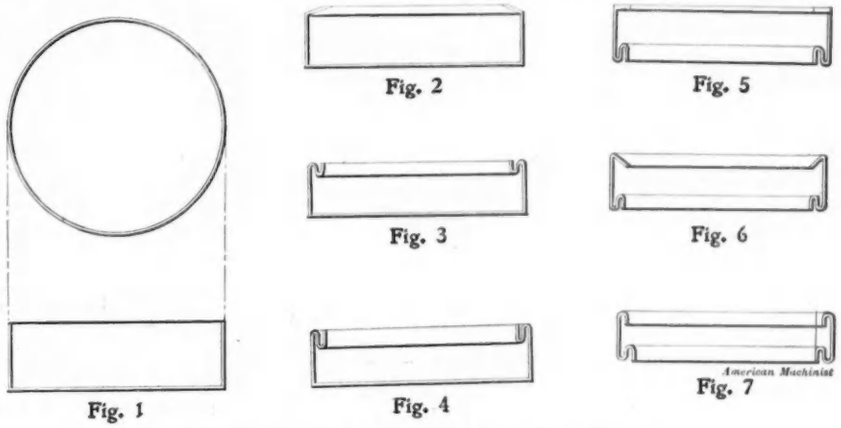
in which d = diameter of drum shaft.

Bending and Forming Dies for Round Work.

BY JOSEPH V. WOODWORTH.

The dies here shown and described are known as circular bending and forming dies, and are very suggestive of ways and means for upsetting and forming the edges of circular-drawn shells into a variety of difficult shapes. The piece of work shown here in the different operations, running from Figs. 1 to 5, was used as a part of a patent fruit-jar cover. The first operation, Fig. 1, was to blank and draw a shell of the size and shape required, which was done in the regular combination die. After this it was necessary to upset, form and finish the upper edge to the shape known in Fig. 4, for which three operations were necessary.

The first, Fig. 2, was to upset or start the uppper bend. The punch and die used are shown in Fig. 8. *A*, the bolster, is of cast iron, and *B*, the die for holding the shell, of tool steel, bored out and finished to just fit the outside of the shell *C* and fastened in the bolster *A* by the two screws shown. This die was also bored 1-16 inch deep at *G G* as a gage for locating the punch *D*. This punch was beveled inwardly at *E*. It was held in a cast-iron holder, *F*, which was used also for all the other punches. The punch *A* and die *B* were hardened and just slightly drawn. The metal used for the shell was sheet tin .01 inch thick. The shell *C* being placed in the die *B*, the punch descending causes the edge to collapse to the shape shown in Fig. 2.



SUCCESSIVE OPERATIONS IN BENDING ROUND WORK.

For the next operation a bolster, *H*, which would answer for all the bending operations, was made as shown in cross-section in Fig. 9, with a plan of it in Fig. 15. It was first bored ¼ inch deep to just fit the outside of the shell; it was then counterbored at *J J* for a gage point in setting the punches, and then planed on the top and the two gibs *L L* finished and each fastened by the three screws, as shown. A slide *M* of flat cold-rolled steel was then fitted to slide freely within *L L* and locate itself against the stop *K*. It was bored out to just strip the work from the punch, the round-head thumb-screw *I*, Fig. 15, being used as a handle to slide it. In operating this slide *M*, it was pulled back far enough to allow the work to be inserted within the bolster, and then slid back to place, and after the descent of the punch the work was stripped and removed in the same manner.

That much for the bolster. In Fig. 9 the punch *G* is worked out and finished to template to the shape shown at *K*, and hardened and polished. In descending, the central portion projects farther and enters the shell *I* before the forming commences, thereby holding the outer edge while it is formed and bent to the shape shown in Fig. 3. The operation of finishing the upper bend was done by the punch *N*, Fig. 10, tapering slightly, as shown, entering the work and gradually forcing it inward and finishing the bend as shown in Fig. 4. The upper bend finished, we were ready for the lower, which took three operations to complete it. The first was to blank the hole in the bottom, as shown in Fig. 5, which was done by the punch and die shown in Fig. 14. *T* is the bolster, of cast iron, *U* the die, of tool steel, inserted in *T*, being held down by the gage plate *V*, which was located on the face of the bolster in a recess sunk true with the die and fastened by the round-head screws. The work *W* is shown just fitting within *Y*. The punch *X* is the ordinary blanking punch, equipped with the spring rubber *Z*, a stripper plate *Y*, and *O O*, the two stud screws for the plate to move on. The action of this is plain: the descending punch blanking the hole, and plate *Y* stripping the work from the punch.

The first bend is shown in Fig. 11, the punch tapering sufficiently to allow it to enter the hole in the work *Q* and the taper part forming it to the shape shown in Fig. 6. The next and last operation is shown in Fig. 12, the punch, tapering slightly and then left straight, descending and finishing the bend, and leaving the work as in Fig. 7.

It was necessary to have some means for setting the punches central with the work, and the piece, Fig. 13, was made, the upper part fitting around the punch and the

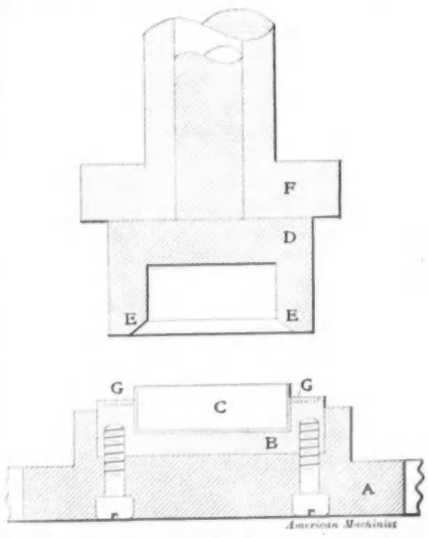


FIG. 8. FIRST BENDING PUNCH AND DIE.

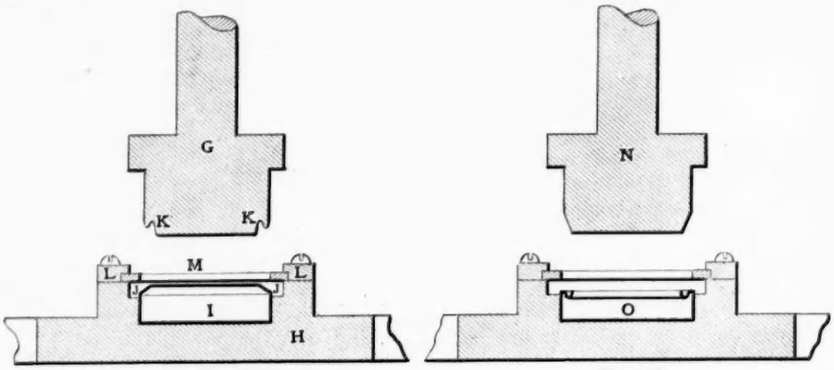


Fig. 9

Fig. 10

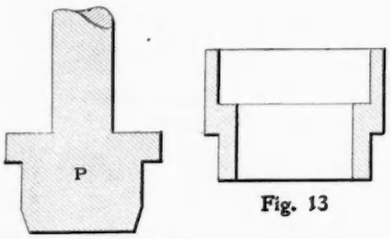
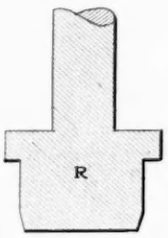


Fig. 13



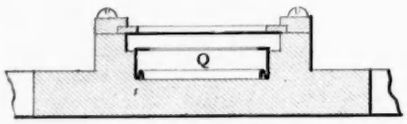


Fig. 11

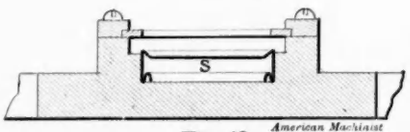


Fig. 12

THE SUCCESSIVE PUNCHES AND DIES AND PIECE USED IN SETTING.

lower part in the recess *J J*, Fig. 9, in the bolster. This proved an easy and reliable means of locating them. In making the punches, templates were necessary in order to get them the proper shape and size, as in work of this kind it is very easy to start a wrinkle, which increases with each operation and spoils the job. All the working parts must be well finished and polished and left very hard, as the bending of sheet metal in this manner wears the punch rapidly.

Although the work looks simple enough, considerable skill is required with the hand tool to get the proper shapes and also, as in combination forming and drawing dies, the first working down and then trying and easing the tight spots, until the exact shape required is produced. Of two styles of bending round work the one here described, that of decreasing from a large diameter to a smaller, is easier than the other, known as wiring or increasing from a smaller diameter to a larger. This form of bending or wiring is used quite extensively in the manufacture of tinware and metal lamps, and it is surprising the variety of work and the symmetry of form that is attained when the simplicity and cheapness of the tools used are considered. The extensive use and improvement of these tools has been the chief factor in the unusual cheapness of sheet-metal ware, as formerly all this was done by spinning. It has also been the means of increasing the usefulness of the tool and die maker. And so it is in all lines of sheet-metal work, the power press being used to-day to accomplish results that were not thought possible a few years ago.

Molding a Gas Engine Bed in a Three-Part Flask.

BY R. H. PALMER.

In a previous issue I described the molding of a gas engine bed by bedding the pattern in the floor. Let us now try using the same pattern in a three-part flask. The drawing is a vertical section of the flask with the pattern in position. The binders *K* are placed in the floor with board *Y* on top of them, and ends of cleats *Z* wedged up. The board being level lengthwise, the drag *A* is put on the board, and sand is thrown into the drag. A level is put on the joint, and the sides are raised or lowered as desired. After being leveled, it is rammed up, and struck off a little below the joint. The pattern, with tie-braces *E*, is now placed in position and wedged up as high as wanted. Some pig iron is placed on it, and facing sand is tucked under the pattern along the under side. The sand is then rammed up around it on the outside to joint *W*, and is tucked up and rammed a little on the inside through openings in the top of the pattern. The pattern can be easily arranged for a piece of the center (between the two openings that belong to the casting) to be removed and replaced at the convenience of the molder. The joint being made at *U*, the side piece at *X* is slipped in between the bars of cheek *B*, and the cheek is lowered down home. It will be seen that bars *D* are bolted to the side of the flask. They may be made in a piece and bolted in, or singly, as desired. The piece *X* is then placed on its seat on the pattern and held by pins on the inside, passing through the sides. The pocket and outside are rammed partly up, and as the point on the outside is reached where the pins holding tie-braces *E* are, they are removed, the vent from the pocket is led back to pockets of cinders placed between the bars, which vent is led to the top of the cheek at joint *S*, or holes may be bored in the cheek to provide escape, as preferred. The outside being rammed up, the inside is next rammed, the pins holding side piece X being removed. All the ramming on the inside is done through the openings in the top of the pattern. The piece spoken of in the center should be replaced at the proper time—that is, when the top of the inside is finished. The joint being made, the cope is rammed up.

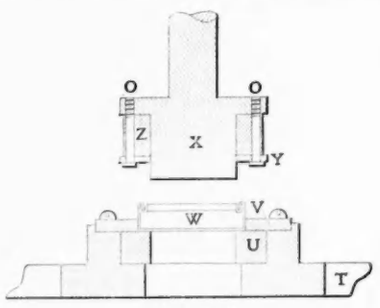


Fig. 14

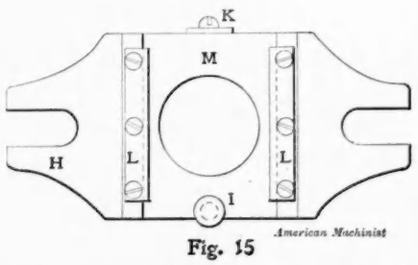


Fig. 15

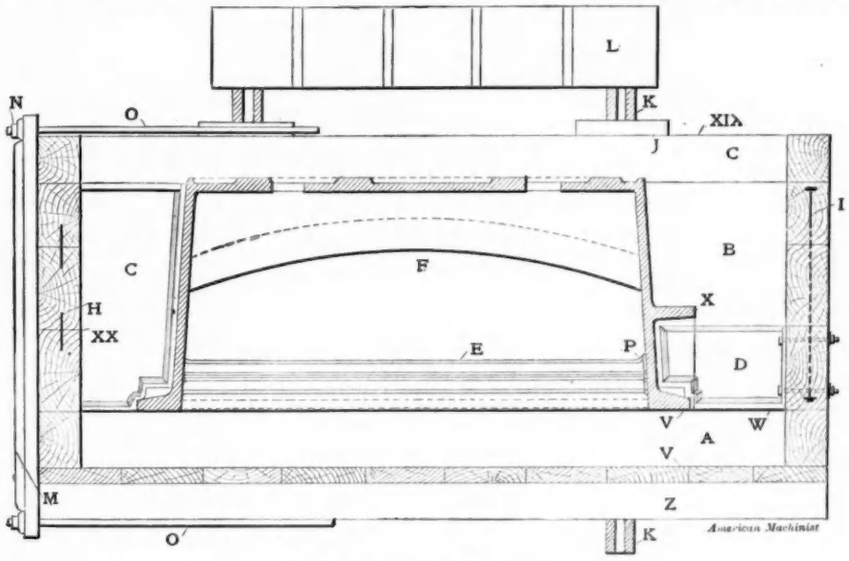
PUNCH FOR THE SECOND SIDE AND PLAN OF DIE AND STRIPPER PLATE.

In regard to gating, I have left that to the one who may be making such a casting. Personally, I would have one set of gates at joint *W*, pouring down through the cheek, then gating into another at joint *S*; at which point I would start a ladle of hot iron, when I thought the iron had reached a hight in the mold of within some 5 or 6 inches of joint *S*, in this way having hot iron to flow over the plate. In securing the mold, binders *K K* may be bolted together, or weights may be used on top of the binders, as at L.

In making such a casting in a flask there is a large amount of side strain, requiring side binders as at *M*. It will be seen that two rods are passed respectively over and under the flask, as at *O O*, it being supposed that there is another binder like *M* on the opposite side of the flask, the two side binders, being connected and held by these rods, thus holding the sides of the flask against the outward pressure of the metal. Clamps, of course, are used to hold the flask together, in addition to either bolts or weights. In many cases

where cheek or drag is very deep, and where the flask is made for a special job, it is better to have the sides bolted through, as shown at *I*, or doweled at *H H*, where a number of planks are required; but in a foundry making a great variety of work, I have found it more convenient to cast a plate, and have it bolted on to the outside of the flask to hold the parts together. Or, in a jobbing foundry, I have found it well to take, say, the cheek apart at, say, *X X*, and in this way I would have two flasks of the same size if wanted, as I could bar either the drag or the cheek.

In taking the flask off the casting, the bolts are driven into the cheek after removing the nuts so that the cheek bars *D* may be left in the casting. One disadvantage in cheeking any piece off with a cheek that is barred, especially with a wood bar, is that if the bars are not tucked very firmly and not rammed very evenly the bars will to a certain extent show on the face of the casting. I do not think any foundryman on reading this will fail to recall some casting he has seen that was made and cheeked off, and where when the sun's rays fell on it he could pick out the impression left on the face of the casting by every bar in the cheek, as, either on account of uneven ramming or improper finishing, the surface of the mold was not of an even firmness to withstand the pressure of the iron when the mold was filling, and if strained a little, or as the molders term it, "not cut quick enough," the results would be the more noticeable. One will often see the above on lathe and engine beds.



MOLDING IN A THREE-PART FLASK.

I may now speak of another way of molding this piece: Turn the drawing upside down and place the bottom board with the face of it on the line *X I X*. Use the cope as the drag. Ram up sand as in bedding the pattern in the first way, leaving out the cinder bed, as in this case the drag would be too shallow; or upset the drag, making it deeper, and then use the cinder bed, bringing out the vent between the board and the drag in either case. Having rammed up to the depth of the drag, add the cheek to the drag, using them as one drag and leaving out bars, except the bars of iron *D*, for the pocket. (Leave them out, if you wish, and rod the pockets as in the first case, anchor out the inside or use a core.) Your bar can be made by nailing to a plain bar in the cope two pieces of board extending down inside the pattern the desired distance and then running a piece to form the bar from one to the other. Gate as you wish, as in the first way, or like the second. You will require the same rigging to secure the mold, as you cannot afford to trust to just the sides of the flask, for they will spring. I think I omitted to say the tie-braces were drawn out after the pattern, sideways.

I have not gone into the details of finishing the mold, or gating particularly, as my object has been to show some of the points of difference in the cost of the rigging required to bed the pattern in the floor, or to make the same casting in a flask with necessary means for securing the mold.

Others may change some points from my ways. In molding, as in every other trade, there are many ways of obtaining the same result which all are looking for—a good casting. Yet I think if anyone will look over the system of bedding work into the floor and compare the cost of making the larger castings in that way with the system which involves the expense of making a flask, with cost of lumber, labor, necessary rods, bolts, iron bars, shop rent while being made, the not unimportant rent of room occupied by it while not in use, and the enormous cost to many founders of handling a large quantity of large flasks in and out of the foundry without adequate facilities for doing it easily and cheaply—I think they will agree with me that a judicious application of the system of bedding patterns of the larger size into the floor and lifting out the inside by anchors or cores, together with constructing the pattern so that the molder can do it advantageously, will help swell the profits of the specialty foundry, save to the laborer many a heavy lift, and his employer many a sigh when he looks over the pay roll.

Air Compressor Explosions.*

BY ALFRED GEORGE WHITE.

EXPLOSION IN A COPPER MINE.

The air compressor was employed for the purpose of supplying air to rock drills and hoisting engines in a copper mine in Norway. The usual working pressure being between 50 and 60 pounds, the safety valve of the receiver was loaded to blow off at the latter pressure. It had been continuously at work for seventeen years, and was of English make, with two horizontal air cylinders, 24 inches in diameter and 36 inches stroke. The motive power was supplied by a high-speed turbine on a horizontal shaft, upon which a pinion was keyed, gearing with a spur wheel on the compressor driving shaft. On this shaft also there were keyed a heavy flywheel and two crank disks, which worked the air-cylinder pistons by means of connecting rods in the usual way. The inlet valves were plain circular valves with stems, four being placed in each cover of the air cylinders. Bell-crank levers fitted with counterweights were attached to the valve stems for closing the valves at the end of each stroke before compression commenced, the atmospheric pressure opening them simultaneously during the inward or inspiration stroke. The outlet valves were of the ball type, of solid brass, fitted in brass seats, two on each delivery port on the top of the cylinders, their action being regulated by the pressure of air in the cylinders and receiver.

The cooling arrangements consisted of an open water jacket round each cylinder, the water supply being admitted near the surface on one side and discharged through an overflow pipe of ¾-inch bore on the other side at the same level. The water surrounded the cylinders and air-delivery ports, and stood about 1 inch deep over the latter. The water supply and discharge being placed at the same level near the top, the water supply flowed over the surface and did not circulate round the cylinder. It will thus be seen how imperfect the cooling action was in this instance.

The oil used in lubricating the air cylinders was composed of crude fish oil and tallow mixed together, and was put into the cylinders through the inlet valves by a common oil can. The lubrication, therefore, depended entirely on the attention and skill of the attendant, and no doubt at times a greater or less quantity of oil

* Abstract from British Institute Civil Engineers.

was poured into the cylinders than was required, and any surplus was driven out through the delivery valves into the air pipes and receiver.

The air receiver, placed inside the compressor-house, consisted of a wrought-iron cylinder about 20 feet long by 4 feet 6 inches in diameter, and was connected to the air cylinders by an 8-inch cast-iron pipe. This pipe had an ordinary spigot and socket joint on the horizontal portion between the receiver and compressor. The joint was made of lead, run in and caulked, but owing to the contraction and expansion of the pipe it leaked, and had to be renewed from time to time. On the day of the ignition, and shortly before its occurrence, this joint had been renewed by running in molten lead against a hempen gasket, and very soon after the compressor was started, flames blew out in great volume from the safety valve on the air receiver. The attendant succeeded in stopping the compressor within a few seconds, but the flames continued for some time and set fire to the compressor-house, which was built of timber, and in the course of half an hour it was burned to the ground.

WHAT CAUSED THE EXPLOSION.

The author considers the cause which led to the fire breaking out in the receiver to have been the ignition of the oil accumulated there and the use of molten lead in making the spigot joint of the pipe referred to, by which the oil must have been ignited in the pipe. On starting the compressor, the draught of the air created would cause the ignited oil in the pipe to set fire to the oil in the receiver, or the fire may have already spread to the receiver. The products of the decomposition of the large quantity of oil in the receiver would, in conjunction with the air, form an explosive mixture, which, failing relief through the safety valve, might have resulted in an explosion. The cause of all explosions and ignitions of this nature can be traced to these phenomena. The case which occurred at the Westphalia Colliery in 1896, resulted in the destruction of the air receiver by bursting. In the present instance the rise of pressure does not seem to have been sudden enough to burst the receiver, and the relief afforded by the safety valve averted this catastrophe. When the receiver was opened it was found to contain a quantity of charred oil in the form of a sticky paste about 2 inches deep in the bottom. The air pipes were coated inside with a similar substance. The damage done to the compressor and receiver was, however, considerable, the riveted joints of the latter being started and the lead joints of the contiguous pipes and connections melted out. One cylinder of the compressor and one crank disk were cracked, as also were two arms of the turbine, which was placed inside the house burned down. The latter effects were chiefly due to the subsequent fire and the water which was thrown upon the heated metal.

The primary cause of the fire was the accidental ignition of the oil by the admission of molten lead into the pipe referred to, but the same effect may be produced by an increase of air pressure, and consequently of temperature, to a point at which the decomposition of the oil and ignition of the air and gas mixtures takes place, or by the admission of coal dust or inflammable matter into the valves or cylinders of the compressor. The use of oils possessing low-flashing temperature from friction of metallic surfaces improperly lubricated is also an element of danger, besides defective water-jacketing and cooling arrangements.

A similar ignition to the one mentioned by the author occurred in 1897 in the Clifton Colliery air receiver, and tests were made of the oil then in use, giving the following results:

	Flashing Point Close Test.	Ignition Point.
Sample No. 1....	454° Fahr.	594° Fahr.
Sample No. 2....	460° Fahr.	588° Fahr.

Lubricating oils of high-class manufacture, distilled from petroleum and used for high-pressure steam engines, give flashing points of from 530 to 560 degrees Fahr. (open test), and ignition points of from 600 to 630 degrees Fahr. It is, however, sometimes the case that oils having a high flashing point are mixed with others having a much lower one, and therefore a guarantee should be demanded, or a test of the oil should be made. The flashing point of the oil used in the compressor described by the author, taking that of Arctic sperm, would be only 446 degrees Fahr. It is evident that, given reliable oil of high-flashing point and normal conditions of working for a well-designed air compressor, the danger of ignition is practically eliminated.

About two years previous to the ignition described by the author, an explosion occurred in one of the cylinders of the same compressor, resulting in the destruction of the cylinder. The cause of this was not ascertained at the time, but it was probably due either to excessive friction in the cylinder or defective action of the valves, causing an increase of temperature and consequent decomposition of the oil, or to an increase in the air pressure sufficient to burst the cylinder.

Difficulties of Securing Business in France.

A contributor to our contemporary, the "Engineering News," graphically describes his impressions of commercial opportunities for Americans in France in a letter to that journal as follows:

"Sir: During the past year in Paris, where I have had charge of a machinery exhibit at the Exposition, I have had an excellent opportunity to observe business conditions and business methods here; and a few notes from my experience may perhaps be of interest to some of your readers.

"It is true that there appear to be splendid opportunities here for the establishment of profitable enterprises, and many American houses have already established successful branches in Paris. At the same time any firm contemplating extension of its business to this field should understand that the difficulties to be encountered by its representatives at the outset are very great.

"The character of the people is so different from the English, German or American that doing business of any sort is uphill work. I attribute it to a lack of courage or the disinclination to decide upon and attempt any thing which is not perfectly familiar. 'Suppose this happens?' 'it is such a departure,' 'I have never seen it done,' are common expressions, whereas an American under similar circumstances would say: 'That is a good idea; I'll try it and if it does not work quite as satisfactorily as we expect, we will work it out somehow; anyway, we will make the effort.' These people see all the difficulties piled up at the start, and entirely forget that these same difficulties would, in reality, come one at a time and could thus be met and disposed of singly.

"Again, they are too theoretical and will quibble over details and lose sight of the results. To illustrate this: One man was interested in one of our machines which was turning over at about quarter speed. I casually remarked that its normal speed was 150 revolutions per minute. 'Impossible,' he replied. 'Not at all,' said I, 'you will notice that it is listed in our catalogue at 150 revolutions per minute.' He persisted that this was out of the question; so to settle the matter I had my engineer run it at 200 turns for three or four minutes. Turning with the smile of a conqueror, I was met by the remark, 'Oh, well, that is only for a few minutes.' The argument that we had many machines in operation at that speed had no weight. I could not convince him, and there was an end to it. This, of course, was a somewhat extreme case, but it is characteristic.

"Then, again, engineers of reputation will haggle over steam consumption and worry themselves and you to the profane stage, while the question of first cost, final results, durability and all that makes true efficiency of an equipment mildews from neglect.

"Besides this, when once convinced, they are not always of the same mind; and when the magnetic influence of your logic no longer surrounds them, they lurch out of the straight road and fall by the wayside in a quagmire of imagined difficulties which necessitate more logic and an amount of mental effort sufficient to boil water.

"A repetition of principles, reasons and powerful arguments administered about four times, at periods of about a month, may or may not bring matters to a head.

If it does, you bear off an order for a machine (on trial).

"Six months of this life would wear six-inch wrinkles into the smiling face of the most winning Yankee drummer who ever rattled over American rails, especially when he realizes that the heads of the firm at home know nothing of the labor he is expending and the difficulties he is encountering, and suspects that they are exchanging sage remarks on the effect of life in Paris to lure exemplary young men from the paths of industry and devotion to business!

"CHAMP DE MARS.

"Paris, October 21, 1900."

Pattern Making—Pipe Work.

BY JOHN M. RICHARDSON.

It often happens in shops where engine work is done, and doubtless in many other places, that pipe fittings are wanted of large diameter and of odd shapes, and that probably will not be used many times, if, indeed, more than once; and so it becomes necessary to reduce the pattern work to a minimum of time and expense.

The examples given here are but a few of the necessary shapes liable to be dealt with in actual practice, but will serve to show how jobs of this kind are sometimes handled, giving one of the many various ways of accomplishing a given result.

Fig. 1 shows a method of lagging a quarter turn, when it is necessary to increase the diameter for some special use, and which would be an awkward job, as well as a long one, if the whole surface was to be covered; but that is not necessary if only temporarily used. Ascertain first the inner, middle and outer radius of curvature of pipe at *A*, *B* and *C*, then band-saw to these curves six strips having a square section equal to the thickness of the required lagging, and attach them to each half of the pattern, as shown at *A*, *B* and *C*. Now get out a lot of pieces *D*, having the same inner radius as the outside of the pattern and the same width and thickness as *A*, *B* and *C*, and nail them to the pattern between the long curved pieces, as close to each other as they will lie conveniently. It will be seen that there is no "cutting and trying" or fitting with chalk in this method, as everything is used direct from the band-saw, and the molder simply fills up the interstices between the strips with green sand, and then uses parting sand over all. The prints will of course be covered in the ordinary way, as shown at *E*.

Figs. 2 and 3 show an offset pipe pattern and corebox with very little pattern work. Lay out the shape of the pipe and the prints on a board; dowel this to a second board of the same thickness, and band-saw the outline. Bevel the edges of each board slightly to conform to the curvature of the strike, then attach flanges and prints, as at *B C*, and make a strike *D* having a semicircle equal to the outside diameter of the required pipe, this to work over the board *A* between flanges *B B*. This completes the pattern. The molder packs sand over the board *A*, shaping it properly by means of the strike *D*. We now have the same shape as we should have if the pattern were entirely of wood. Newspaper is next put smoothly over the green sand form, to act as parting sand, and the mold rammed up as with a common pattern. When the flask is turned, the cope is put in place and done in the same manner. Finally, when the board with the flanges is withdrawn, the sand remaining is easily removed, being separated from the mold by the paper previously mentioned.

The corebox, or, more properly, the frame, is shown in Fig. 3, and is very simple, consisting of two curved strips *C C*, of sufficient width to prevent springing, and parallel their entire length, with two ends *D D* of the same thickness. The length of the frame inside is as much longer than the board *A*, Fig. 2, from end to end of prints, as the thickness of the two heads *E*, which are fastened with screws to each end of the frame. The core is rammed on a plate and struck off with the sweep *F*, thus allowing the frame to be lifted off without disturbing the core, which is quite an item, for it is a job to turn heavy coreboxes over and lift them from the core. It will be noticed that this job requires one right-hand and one left-hand core. To make the opposite one, simply unscrew the heads *E E*, turn the frame the other side up and screw them on again, using the same strike *F* as before.

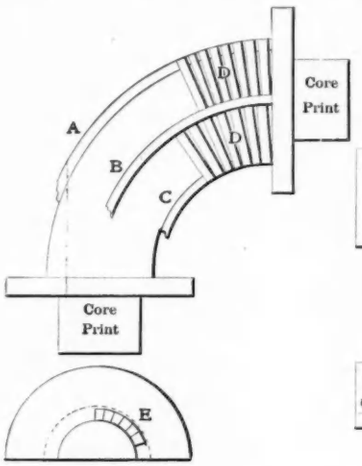
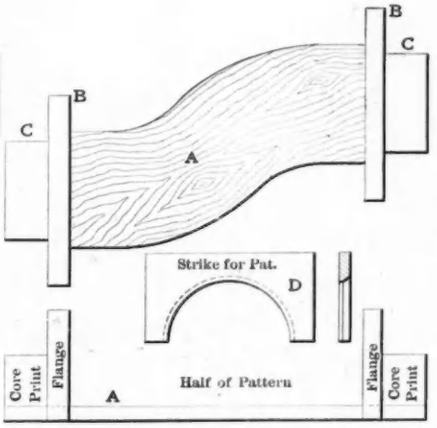


Fig. 1



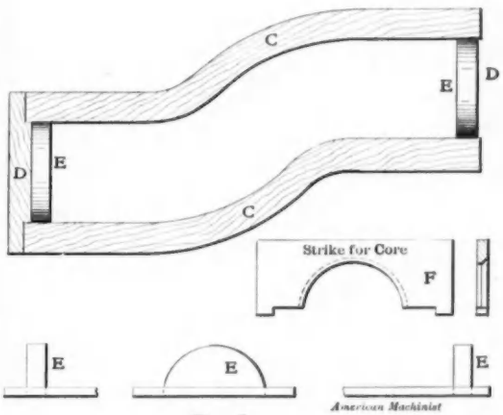


Fig. 2 Fig. 3

PATTERN WORK FOR PIPING.

Fig. 5 shows a core frame for the U-pipe in Fig. 4. It consists of a wide board *A*, with the outline of the outside of the core sawed in it. *B* is the same thickness, being the inside outline of the core. *C* is an end strip to hold the two parts in position. *D D* are two heads having the same diam-

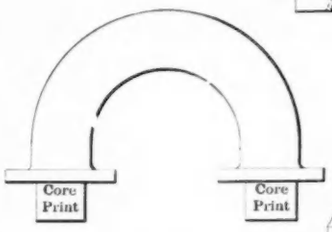


Fig. 4

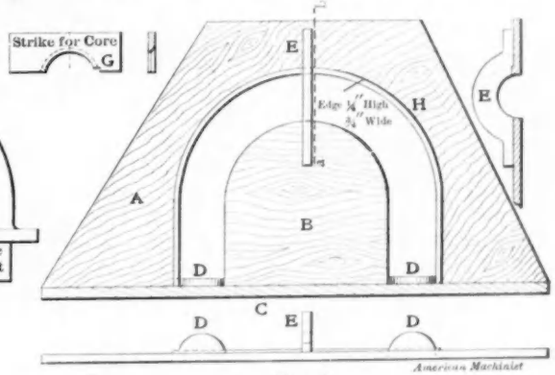


Fig. 5

MAKING A U-PIPE.

eter as the core, and *E* is a bridge piece to strengthen the frame, shown more plainly in section at the right. The half circle just matches that of the strike *G*. A little ledge *H*, ¼ inch high and ¾ inch wide, is nailed around the opening on the board A to guide the strike. It will be observed that there is a place cut in the strike G to match this ledge, and that the center of the curve is as much below the bottom edge as the thickness of the board *A*.

Letters from Practical Men

Emergency Engineering on the Northwest Coast.

Editor American Machinist:

At the Gray's Harbor Commercial Company's works, in the State of Washington, considerable trouble was experienced with a large double crank shaft. From the design of the engine, one side of it had to transmit its quota of power through the crank pin of its mate. The builders of the engines had provided for this, or thought they had, by shrinking heavy bands on the crank disks and increasing the size of the pin to 8 inches, where normally a 5-inch pin would do. Originally this pin was pressed home and then beaded or riveted over on each side; but it soon worked loose. A new pin was put in, with no better results. Plans were then laid to make a new crank shaft complete.

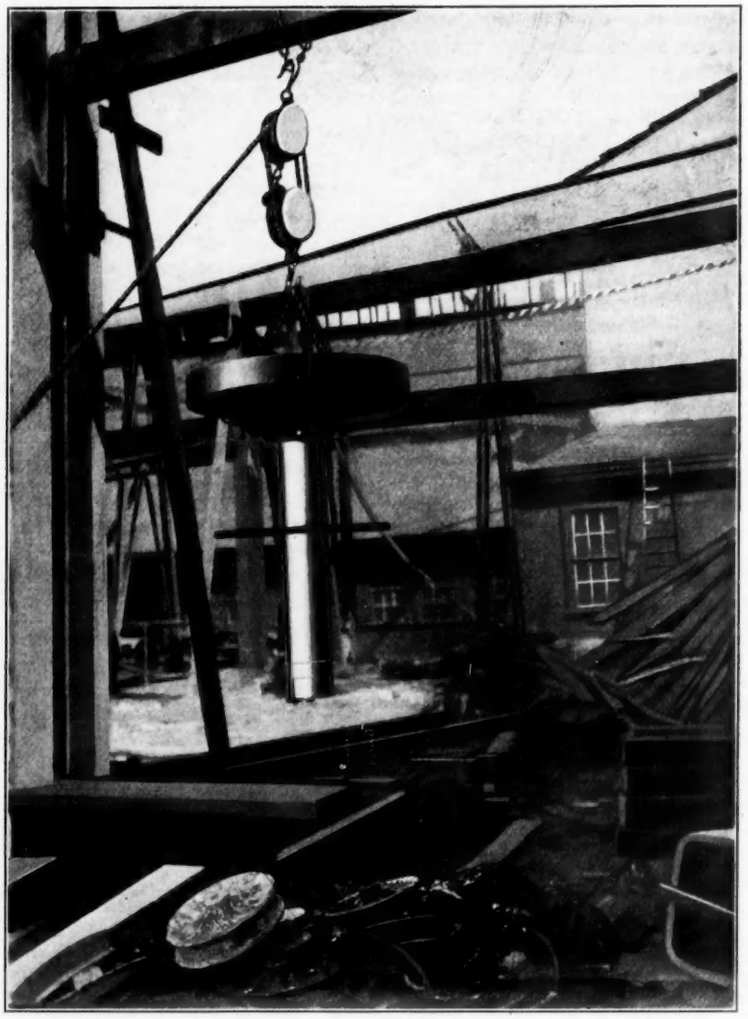
The home shop equipment of tools consisted of one 14-inch and one 24-inch lathe, one drill press and one 20x20-inch by 4-foot planer. These were small tools for this heavy work, but that did not deter the management from the undertaking.

Four steel crank disks, bored and faced, were ordered from the East. Forgings for the shaft and crank pins were bought in San Francisco. The coupling was cast at a local foundry. The shaft pieces were turned and finished to 10 inches diameter, as required. The ends, as far as they stuck into the crank disks, were turned to 9¾ inches, with a good allowance for shrinkage.

The crank disks were now rolled out into the open air. Two rails were blocked up parallel with each other and the proper distance apart, so that one of the disks could be laid upon them flat and slid along from one end to the other. At one end of the rails a wood fire was built up around the crank disk, as seen in the photograph, and when it was hot enough the shaft was hoisted up by means of overhead tackle blocks. A large iron hook was then dropped into the crank-pin hole, and the crank disk was pulled along on the rails until directly under the shaft, and the shaft was then lowered into its place. A stub key had previously been fitted into the shaft, so that no entrance could be made until the keyways were fair. This operation was repeated until all four disks and the coupling were shrunk on. Not a hitch occurred; all went as easy as rolling off a log.

The head and footstocks of the lathe were blocked up, high enough to swing 50 inches, on special raising blocks previously provided. Five strong stands, something like steady-rests, were clamped side by side on the V's of the lathe, and bored out with a boring bar to a neat fit for the crank shaft. The lathe was then stripped of everything; the legs were taken off and the body of the lathe was lowered upon two parallel sticks of timber. The shaft was rolled up, and the stands slipped under and clamped fast. This operation completed, the crank shaft rested clear of everything and supported only in these stands; consequently there was no possibility of the shaft being axially out of true. In this position a portable boring bar was put up and the crank-pin holes were bored out.

A fire was started between the two disks with a strong blast and charcoal fuel, the cranks were soon brought up to a dull red all around the crank-pin holes, and the crank pin was shoved in, with a good allowance to make a tight fit. During this heating, a small stream of water was run continuously on the two stands next to the crank disks; this kept them nice and cool. The second pin was put in in the same way. A belt was now run around one of the crank disks and connected to a convenient pulley, and the coupling was faced off by using a portable tool-rest. A portable grinder polished the disks, and the job was complete. PACIFICUS.



GETTING READY TO SHRINK THE CRANK.

Rectangular Emancipation.

Editor American Machinist:

The title above may do to catch somebody's attention, and so far it may be all right, but beyond that it is not all right, and I am not sufficiently word expert to make it right. The emancipation which I at present have in mind may be rectangular or it may be shapeless, but it is to free us from our slavery to rectangularity. It is not easy to realize on the one hand what slaves we are in all our mechanical operations and devices to parallel lines and the right angle, and, on the other, how absolutely free from any obligation to either is Nature's handiwork. We are tied to

the T-square and the triangle in all our designing, while no natural product is produced or even can be depicted by their employment. This suggests how narrowly we are hampered in our operations, and accounts for much of our incompetence and the unsatisfaction still accompanying many of our results.

If we can be released from our bondage, in thought and in practice, to the level, the straight line and right angle, a most serious and hitherto constant drag will be thrown off, and our progress cannot fail to be more rapid than ever before. Our emancipation is at hand, for the emancipator is ready. This, of course, is the electric drive, one of the most important, revolutionary and valuable features of which is in its absolute rectangular independence. It has no cognizance of direction or position, and works precisely the same, no matter how it is placed or connected. We are beginning slowly to realize the value of this one unique feature of the electric drive and to take advantage of it. The driving of single machines by the use of individual motors is becoming quite common, thus enabling the machines to be placed precisely as most convenient or desirable for the facile manipulation of the machine, the supplying it with material and the disposing of its product. The mind of the designer is still to be emancipated, and then the objectionable straight lines and right angles will be driven out of the machines themselves. We must expect to see new lines of machines coming out in which the motor will be incorporated as a part of the machine, to its great simplification, instead of, as now, applying the motor as opportunity offers to complete machines which were designed and built before the electric drive was in sight. We must get out of our rut of rectilinear and rectangular thought and be free to wander where we will. We must remember the electric motor as always ready and almost universally applicable, just as the designer of the automobile is called to forget, as he has not yet, the horse and all his associations.

What started me thinking along this line just now was my looking over a recent patent for a radial drill. The drill referred to, although the patent has only recently issued, is, I believe, already on the market, the product of a well-known machine tool builder. I might have taken any other drill just as well for my example, only I happen to have this one. In this day of electric drives in shops it is very likely that in some shop one of these drills will be driven by an electric motor; but the way in which it will be driven will be by applying the motor to drive the already existing cone-driven shaft, and so on through the various gears and shafts to the drill. In this way not a half of the possible advantage is gained.

The drill is, I suppose, what you might call a "universal" radial drill, according to the way the word "universal" is applied in the nomenclature of the machine-tool trade. There is the usual round vertical part to start with, and on this a long sleeve that can be turned around the post, with upright slides on the side and a saddle to be raised or lowered on these slides. There is a cross-slide on this saddle in which the radial arm of the drill slides in or out for setting the drill at different radial distances, and the drill spindle mounting, and all its adjusting and operating mechanism, are secured squarely against the outer end of the radial arm. This drill spindle mounting is on a central axis parallel with the length of the arm, and on this axis the drill can be swung and operated at any angle in the plane at right angles to the arm. It cannot be swung also angularly in the line of the arm, so that it is not fully and properly "universal."

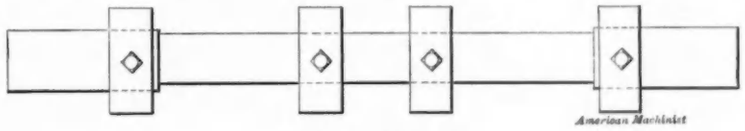
The drill is driven in the usual way by a countershaft overhead, with a belt from the cone on the countershaft to another cone, a part of the machine proper, on a horizontal shaft near the floor. Now, let's see what constitutes the train of connecting and animating mechanism from the driving shaft to the drill. The cone may have, say, four steps, and there will be with it the usual back gears for giving the proper range of speeds. The inner end of the driving shaft connects by bevel gears with an upright shaft in the center of the post, and this connects by spur gears with a splined vertical shaft outside the post and carried around with the sleeve and saddle and arm when they move. A miter gear on the splined upright shaft meshes into a miter gear on a short intermediate shaft, and a spur gear on the intermediate shaft meshes into another spur gear on a long, splined, horizontal shaft running lengthwise of the arm with a bevel pinion on the end meshing into a bevel gear on a sleeve splined on the drill spindle—all this in use all the time to drive the drill spindle. Now throw it all away, and the post and sleeve and saddle and radial arm become so simple that most designers would be ashamed of it, as it would not give them sufficient opportunity to exhibit their abilities. The stripping off of all this train of mechanism is, however, what we are coming to. With all these gears and shafts and things, it would still be impossible to swing the drill in the other angular direction spoken of. To make it absolutely "universal" would require several more gears and involve considerable more complication. Bring the electric drive right to the drill spindle at once with a worm on the motor shaft meshing into a speed-reducing intermediate shaft, and this geared directly to the drill spindle, and there you are. The drill can then have a spherical mounting and can be set at any angle required, the motor, feed and everything all swinging together, and at whatever angle the drill might be working, all retaining absolutely their positions in relation to each other. There would only be the screw for raising and lowering the arm not yet provided for, and this could be driven by another little motor on or near the top of the post. It seems to be evident that a drill might be built in some way as here suggested, simpler, cheaper and better than any we now have, and this, then, would be only a sample of the rectilinear and rectangular emancipation that is coming.

TECUMSEH SWIFT.

Babbitt Rings and Ledges.

Editor American Machinist:

In No. 47 of the "American Machinist" I noticed an article entitled "Rings and Ledges for Holding Babbitt in Cast-Iron Boxes," signed "Hoodoo," in which reference is made to my article published some time ago describing jigs, etc., for machining castings for small engines, and calling attention to the use of babbitt holding rings at the ends of the crank-shaft boxes, and the boring of those rings.



BABBITTING ARBOR.

If "Hoodoo" had carefully read the article, he might have recognized the reason for using the rings and also for boring them, although it may not have been stated in so many words that the rings were not used particularly for the purpose of holding the babbitt, as originally intended, but for the purpose of being bored perfectly at right angles with the facing of the end of the frame. It would hardly be expected that anyone would construct an expensive attachment for a boring mill for the purpose of boring the rings to simply form a part of the bearing surface. The rings were bored ¼ inch larger in diameter than the bearing, for the purpose only of receiving the babbitting arbor, whereby the bearings could be babbitted in perfect alinement with the other parts of the frame. Being, as they were, ¼ inch larger than the bearing, they could not injure the shaft.

The arbor used was like the sketch, the large part resting on the bored surfaces at the outer ends of the bearings, the rings at the inner ends being covered by the babbitt. By this method perfect alinement was secured without the use of jigs or depending on the skill of the workman. Good practice does not necessarily discard everything old, but utilizes even "such excrescences" to accomplish a desired end

with the least cost. This is a case where the babbitt rings, although not at all necessary for holding the babbitt, were just the right thing for the purpose for which we used them.

In regard to the ledges, the case is entirely different. I fail to see what better or cheaper method can be used for holding the babbitt. If the ledges are properly made, they cannot injure the bearing. Does "Hoodoo" expect the babbitt to adhere to the plain surface of the casting, or does he know of some better and cheaper method of securing it? B. W. F.

A Useful Boring Attachment.

Editor American Machinist:

The accompanying drawing will show a lathe attachment which I used some years ago in boring out a large number of couplings to fit some 6-inch shafting. I found it to be a very good thing, and having been around quite a good deal in different shops, I never have seen one like it. Still, there may be those that have; but for the benefit of those that have not, I give it for what it is worth. The couplings I speak of had to have quite a bit bored out of them, so I used three cutters, a roughing cutter, a second one for taking out the balance of stock, leaving about 1-100 inch for the sizing cutter, giving a smooth, straight hole and a good fit, all being alike. In the absence of machines adapted for this class of work, such an attachment for carrying a stiff boring arm will be found to be very useful and quite a saving in time. The sketch will show clearly how it is used and connected to the carriage of the lathe. Being on the back of the rest, the regular tool-holder is not interfered with. The dimensions may of course be altered to suit any lathe. A. M.

Technical Education in India.

Editor American Machinist:

I was much gratified, on reading your review of my lecture on "Technical Education for India" in your issue No. 37, to see it so ably handled. Very few writers on this subject seem to have got over the idea that under certain circumstances literary instruction is no education at all.

The educational system of the Indian Government has done infinite mischief to the country. It has unwittingly set up false standards of knowledge, and has encouraged a fatal preference for clerical as against technical occupations.

Instead of multiplying professors, we should be training artificer instructors. No other course will save our industrial situation. JOHN WALLACE.

Bombay, India.

Punching Holes in Cast Iron.

Editor American Machinist:

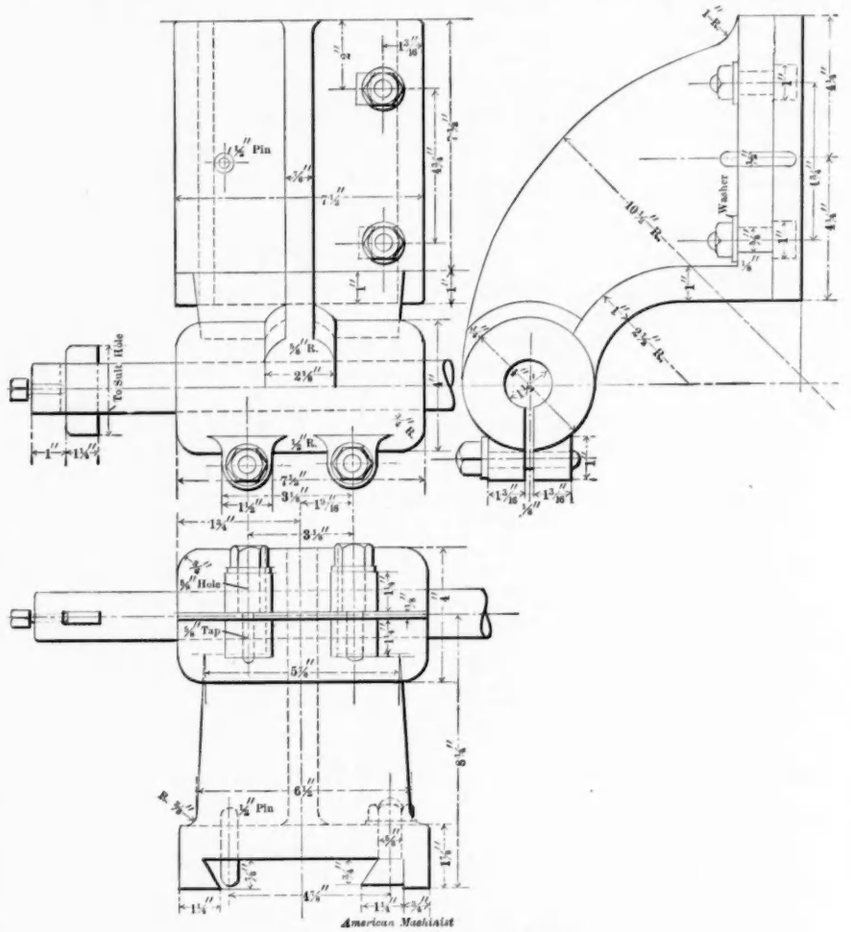
Replying to the inquiry of "C. W." as to punching holes in cast iron, I wish to say that some fifty-eight years ago I punched thousands of such holes in stove castings. The work was done with a hand lever punch, the punch and die made precisely as they would be made for wrought iron.

H. C. FISH.

Developing a Manhole Facing Machine.

BY H. P. G. NORSTRAND.

The machine described in this article, the general construction of which is shown in Fig. 1, was designed to face off the flanges of elliptical shaped manhole openings, of the kind known as "eclipse manholes," in boiler heads, tank heads, etc.



BORING ATTACHMENT FOR LATHE.

The usual way to prepare this flange for making a tight joint is to chip it by hand, using a planed, elliptical-shaped cast-iron ring as a surface plate. This hand operation is rather slow, requiring from 2 to 2½ hours, and is work which must be done by a boilermaker. It was principally to reduce the cost of this work that the machine was built, and also to make a better job than is possible by hand. The work to be done throws a severe strain on the machine, and everything must be made correspondingly heavy and strong. The flange to be faced presents a scolloped appearance, caused by punching out the hole in the head, preparatory to flanging, with an ordinary round punch, and this makes the first three or four cuts around the flange react very hard on the machine.

Referring to Fig. 1, the machine consists of a cylindrical frame resting on a planed base-plate, and a circular stationary face-plate on the top of the frame. The spindle, carrying on its upper end the tool-holder, rests in a step on the base-plate, and extends up through the center of the face-plate, to the bottom of which is secured the upper bearing for the shaft, fitted with a taper brass bushing, and a cast-iron thrust collar under this bearing. The spindle is made to turn at the rate of six revolutions per minute by the gearing, as shown. On the upper end of the spindle, the tool-holder with feed arrangement is carried, the end of the shaft being threaded and counterbored to receive the vertical lifting or adjusting screw by which the tool holder is set for various hights of flanges.

In the machine as first made, the entire tool-holder had to be moved down for every new cut, which was done by slacking off the bolts clamping the two halves of the tool-holder on the spindle, and then using the adjusting screw. The cutting tool, an ordinary round-nose tool, was fed into the work by a horizontal screw and the usual star-feed arrangement. The machine constructed in this way showed, however, when put to a test, no appreciable

saving in time over the old way of doing the work by hand, the loss of time being due to the number of resettings of the tool-holder, and the considerable distance to be passed over by the cutting tool for each revolution.

The next move to improve on this state of affairs was to substitute a large cutter-blade, wide enough to reach the flange during the entire revolution, instead of the round-nose tool. This blade was held by a cast-iron block, secured in the dove-tailed slot of the tool-holder by set-screws. The horizontal movement of the cutter was now no longer necessary, but, instead, a vertical movement of the entire tool-holder, with the cutting blade, was given by the vertical adjusting screw in the end of the shaft. This screw, however, was soon found not to be of sufficient strength for the severe strain thrown upon it, and the entire tool-holder was finally assigned to the scrap-heap, and a new one of entirely different design made to take its place. Fig. 2 shows this design so clearly as to make any further explanations unnecessary.

The machine was also geared up from a ratio of 5.33 to 1 to a ratio of 26.8 to 1, to give a sufficient increase in driving power for the increased capacity of the machine. Instead of the pulleys on the bevel pinion shaft, as shown in Fig. 1, a large spur gear was put on this shaft, and the pulleys were then placed on another shaft alongside, with a spur pinion in mesh with the gear.

It was now found that a manhole flanged in a boiler head of a thickness up to and including 9-16 inch (which is the extreme thickness which can be planed on this machine) could be faced off complete in from 15 to 20 minutes, this including the time necessary for bolting the head to the face-plate and removing it again after the work was done; this great saving of time over the first arrangement being of course due to the fact that the tool-holder remained clamped in one position on the shaft during the whole operation, the sliding rest with the cutter only being fed into the work.

The vertical adjusting screw was retained to perform the work for which it was originally intended, viz.: to adjust the head for various hights of flanges above the face-plate. It may be noted in conclusion that the elliptical shape of the tool-holder was given it in order that the boiler head could be dropped down over the tool-holder to its position on the face-plate, and also be removed from the machine in the same way, the tool-holder passing through the manhole.

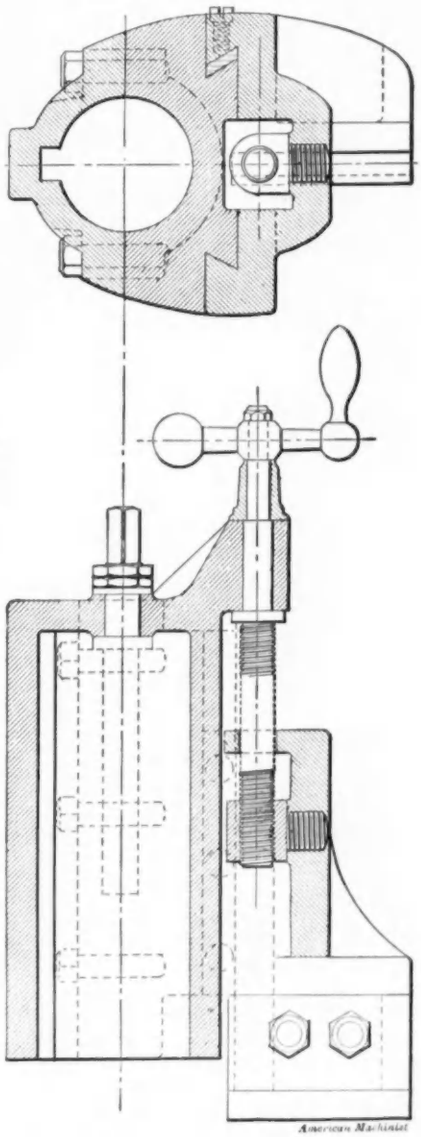


FIG. 2. SLIDE AND ADJUSTMENT OF CUTTER.

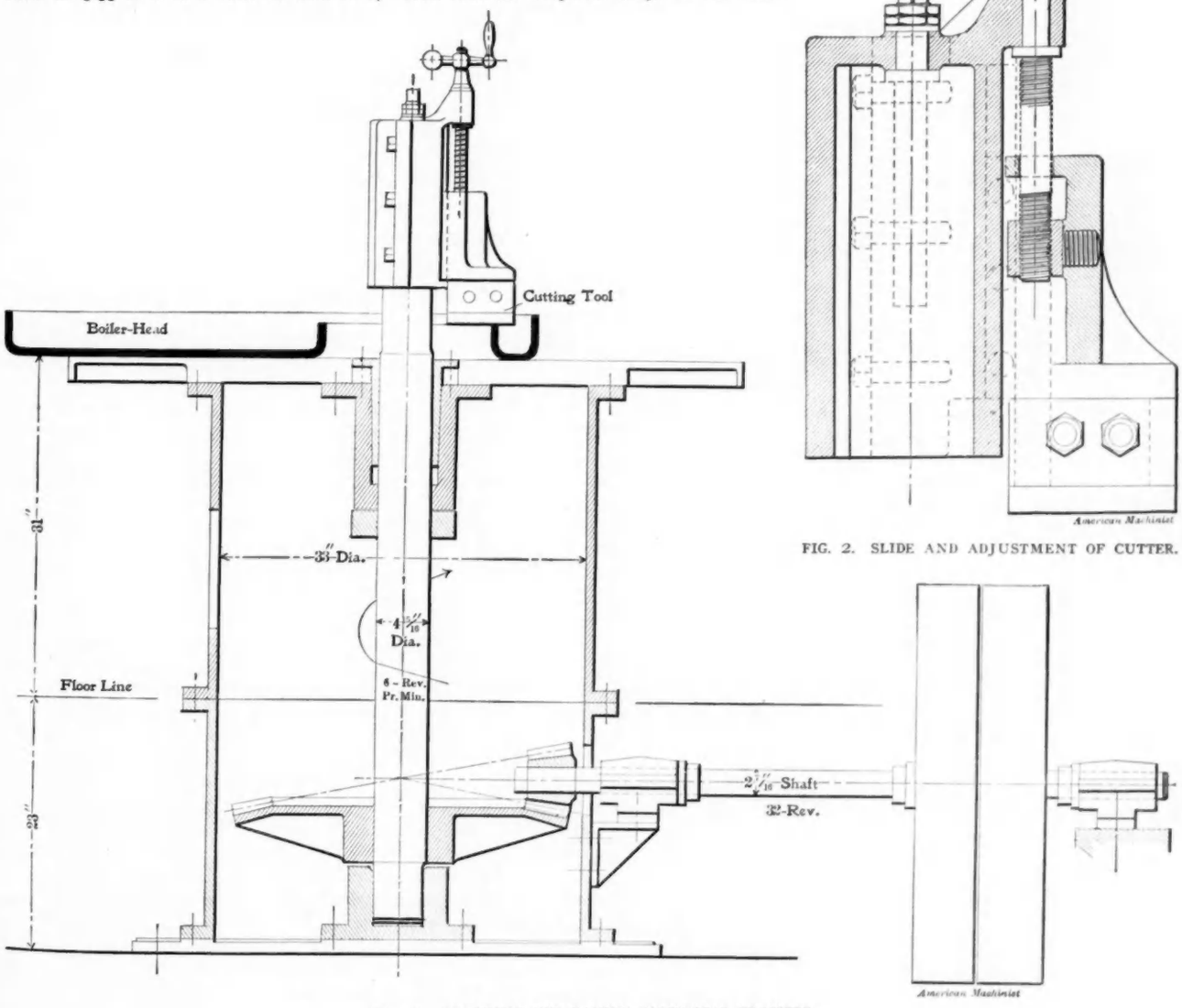


FIG. 1. MACHINE FOR FACING ELLIPTICAL FLANGES.

Echoes From the Oil Country—XI.

WHAT IT COST TO BUILD THE ENGINE.

Mr. Smith was very well pleased with the engine when it was completed and running—indeed, much more so than I was, as I seemed to see all the trouble we had with it, and all the compromises we had made to get things to fit each other, sticking out all over the engine.

This engine Mr. Smith took for his own use, and it was built to fill in odd times with the men, and so the cost of it did not very largely concern us; but as I had known that we were likely to make more of them, I had kept track of the time, so as to tell, reasonably close, what we could afford to sell them for and be on the safe side.

As the hours kept rolling up, my spirits began to fall. I realized that the men were doing very well with what means they had, and that they could do almost anything if given time enough; yet as soon as the time became the controlling factor we were falling behind in the race—to say nothing of the pattern work (the hours of it, by the way, would scare you), or the castings, that cost so much more than 3 cents per pound that I hated to look at the total, and preferred to take the boss molder's fiction of 2½ cents, about; or the forgings (here we saved money, as they were the cheapest things on the engine). We had bought the crank finished, and the other forgings had been made from old iron, the total cost per pound being something less than that of our castings; and they were good forgings, too—nice and true to size, and sound. But in the machine shop we seemed to lose time everywhere.

We had a good rig for reboring cylinders. We could take a cylinder of any size, style or make, catch and hold it so as to run a cut through it, and deepen the counterbores, if necessary, and do it at a reasonable cost. Taking a rough cylinder, and boring, facing and turning the edges of the flanges was another thing, and it made some more gibs, for holding the lathe carriage down, a part of our equipment before we were through. I had seen some builders' claims of five cylinders per day for their boring mill. I don't like to tell just how near mine came to being just the other way; but that really came nearer to my time.

Think of the planing on our little planer, and the floor work, the putting together to mark and the taking apart to drill, the filing of holes that didn't come just fair with one another, the filing on the end of the cylinder to make the bore and the ways on the bed line up. Don't grate your teeth and frown; we had to do something, and often have to do worse things than that to make things come right. I knew the engine would use less steam if it exhausted with less of a bark like a hound after a fox, but I don't suppose the doctoring done to make the exhaust even helped the economy much, although it helped my feelings lots, as the rustic engineer and the rustic not-engineer all seem to judge an engine entirely by the sound of the exhaust and lack of sound elsewhere; in both of which points they seemed to be well pleased, especially with the exhaust.

"Why, she sounds just like a locomotive," said one enthusiastic admirer. I grinned outside, but groaned inside, at this and similar compliments. "Just look at the way she throws the rings from the end of that pipe." I looked and wished there was less steam and less force to make the rings, and more room in the steam chest, so that I could make a valve with more lap and put on an eccentric with more throw and make her cut-off earlier; but I couldn't. "Where ignorance is bliss, 'tis folly to be wise," so I didn't do much educating among my rural critics and, possibly, admirers.

The painting was almost enough to drive a weak-minded man to drink (that refuge of the weak when things go wrong and the boss jumps on them). Did you ever take a rough casting with humps and hollows, seams and furrows, warps and sand holes in it, and chip, file and putty until tired, and think it looked worse than when you began; then try and see if a coat of paint wouldn't make it look all right, only to find that the paint seemed to accentuate every blemish, besides peeling and blistering and running into ridges on its own account, in a very exasperating manner, besides taking on various shades in different places and staying soft long enough to catch all the kinds of dust and dirt in the whole township, and while the performance is at its hight have everyone that comes along tell you how nice some other color would have looked, no two agreeing on the same color as the pretty one, but all being unanimously of the opinion that the one you are using is the very poorest one possible? Getting a house painter from outside and having him laboriously work paint into all the joints doesn't always improve matters, or at least it did not with me.

After looking the engine over carefully, I sat down and looked the situation over. I had made an engine that would run and work, sure enough, and that was better than a complete failure; but I must admit it was not better, cheaper or prettier than the average. It had no new ideas or features that would bring attention and a high price.

And, above all, to be able to build and sell them, I must have different tools. It slowly trickled through my brain that if I should get fifty of them out, no two would be alike, and when the repairs began to be called for, I would either go crazy or have to leave the country to avoid being thrashed by some wrathful owner of a sawmill, who had a gang of men waiting while he went to the shop for a new crosshead, for instance, and couldn't see why the one on the engine on the floor wouldn't fit without knocking out the babbitt and sending out a man to rebabbitt it at the mill. I knew, though, as I know the guides would not be the same hight and the pin would be a different diameter, and perhaps the stroke just a hair off where Billy's dividers moved as he laid out the crank.

Mr. Smith is a good-natured man, and when the situation was gone over with him, concluded we had better make up the castings we had on hand, and then stick to the jobbing business until either we grew larger or times got so that people wanted engines worse.

Some day when I have time to design an engine clear through, and get all the details perfect, we will go into the engine business again. In the meantime I have credited my personal-experience account with a large item which I fear must be balanced by an entry on the other side of Mr. Smith's cash acocunt, which I hope will hold out until my experience ripens.

W. OSBORNE.

A Strong Machinist.

A friend sends us a clipping from the "Boston Globe," which paper has been publishing a series of articles on the strong men of New England. Some wicked machinists must have gotten hold of the Woburn correspondent of the "Globe" and "filled him up" so that he sends to his paper the following important information:

Woburn, Oct. 12.—William J. McCarthy of this city deserves to be ranked among the strong men, even if he is of small stature. He can give points to those much larger than himself. "Billy," as he is called by those most intimate with him, is a machinist, and is regarded as one of the most muscular in the trade hereabouts. It has been a common thing for him to lift an 11-tooth pinion gear and hacksaw at the same time and carry them the length of the factory. He once lifted a whitening machine cylinder and held it two feet from the floor for one minute. He was formerly goal tend for the Woburn polo team, and was a most efficient man in that important position.

Train Takes Its Own Picture.

After repeated failures to secure a satisfactory negative of a train in motion, Ayrault Green, an expert Chicago photographer, recently made the Burlington's Denver Flyer take its own picture. This he accomplished by an electric switch which, when connected with the rail, closes the circuit as soon as it is struck by the engine. The switch communicates with a set of dry cells, and thence to a shutter release.

When the successful test was made, the switch was put in place about 6 feet behind the spot where it was calculated that the front of the engine would appear when the shutter was released

More Experience With the Premium Plan.

Some months ago a friend, who desires that his name be not published, wrote us for a list of shops in which the premium plan had been adopted. Such a list was at once sent, and our correspondent proceeded to select from it eleven representative names and then to open a correspondence with the parties selected, in order to obtain their experience with and conclusions regarding the system. Ten of these parties replied to the inquiry. The eleventh did not reply. The inquiry as sent to all was in the same words, and included the following categorical questions:

1. Is it your opinion that the system can be profitably used in any manufacturing industry?

2. Knowing what you do to-day of this system, would you adopt it had you not already done so?

3. Can it, to advantage, supersede the piece-work and day-wage systems?

Every one of the ten who replied gave as an answer to these questions, "Yes." Further comments were also made, of which abstracts are given below.

These replies are certainly remarkable in their unanimity. We think it would be hard to find any subject of whatever kind, connected with machine-shop management, on which similar agreement could be found among a like number of managers selected, as were these, at random. If any shop manager can read these replies and still deny that the system has merit, we must conclude that he is incorrigible. We hope our readers will "read, mark and inwardly digest" this record of experience. The letters come from New England, the Middle, Southern and Northern States, Canada and England, and from shops having ratings with the commercial agencies of from $5,000 to $300,000. Their credit is uniformly high, and the products produced are widely varied.

Manufacturer No. 1—Commercial rating, $5,000 to $10,000; products, machine tools and sundry supplies. Referring to the three questions, this party answers: "Emphatically, yes," and further states that "the premium plan is distinctly superior to the piece-work system, because it lowers the price per piece while increasing the men's wages. We do not care to go into particulars in regard to our own results obtained by it. The most difficult part of the premium plan is not its application to the workmen, but the self-restraint which it imposes upon the management. There is the strongest kind of an inclination on the part of the management to set a limit to the wages which they will allow a man to earn. If you do not allow this feeling to get possession of you, your use of the premium system will undoubtedly be very successful."

Manufacturer No. 2 (located in England)—Commercial rating not found; products, iron founders' supplies, general engineering work; contractors to the War Office: "It is barely twelve months since we adopted this system, and that in our machine shops only. We hope eventually to adopt it all over our works, and, generally speaking, the system has all the advantages claimed for it."

Manufacturer No. 3—Commercial rating, $75,000 to $125,000; products, engines and engine fittings: "The premium system is at present giving us fair satisfaction. We believe it is superior to the piece-work system in shops where you cannot produce a large duplication of parts of the same size, as the premium system can be applied to a larger number of jobs and to a larger class of work. We should be pleased to go into details fully if you will call upon us, but would not care to discuss the matter through the mail."

Manufacturer No. 4—Commercial rating, $75,000 to $125,000; products, machinery and tools, lathes. "In regard to our experience with the premium system, we refer you to the 'American Machinist,' where you will find articles which embody the experience which we have had."

Manufacturer No. 5—Commercial rating, $300,000 to $500,000; products, electrical apparatus up to, say 1,000 horsepower: "We would not care to go into details of our premium system, except in a personal interview. Our system is very much like the one described in the 'American Machinist.' We have found it far more satisfactory than the piece-work system and think it can be applied to any class of work. We find in operating the system that Mr. Halsey has in no way exaggerated its merits. We pay at the rate of one-third of the time saved."

Manufacturer No. 6—Commercial rating, $50,000; products, boot and shoe machinery: "We apply the system to separate operations and to putting up the machines. Our experience with the premium plan has convinced us that it is the right thing. It takes a little time for men to see its operative value to them, but they soon do see it and then the value immediately increases both to the workmen and the company. It is particularly valuable in bringing forward units where there is considerable hand work and many small manipulations. We have always found the men who earn the most bonus to be the best workmen. We do not find that the favorable results immediately reach a maximum, for the very simple reason that a man will often make several experimental attempts to improve his method. That takes time, but when he gets his machine to working at its highest efficiency, the product of course is rapidly multiplied and he makes money when working under a premium system. We do not believe that anything else would induce the individual workman to put forethought into his work to so great an extent as he does when paid cash in direct proportion to the effort which he puts forth. We find that the workmen become more intelligent and that their output is far better than when under the piece-work or day-wage systems. We pay one-half the time saved. We estimate about 25 per cent. increased output per unit equipment. There is one thing of great importance in adopting the premium plan: the person who fixes the prices, limits, etc., must be one of experience and competent to judge of what an output should cost in its various parts and operations."

Manufacturer No. 7—Commercial rating, $200,000 to $300,000; products, rock drills, grinding machinery, general machine-shop products, contractors to the United States War Department: "The system is superior to either piece-work or the day-wage systems in that the workman has before him the incentive to increase the product with *no limit* as to the increased benefit to himself. When a workman increases his profit, the shop profits by the increased production and also has a part of the saving in money which is paid for the work. The premium method depends for its value, as does any other, upon the way which it is applied. Another advantage over piece work is in that it is not so hard to introduce. Having used the system in our various departments, we know that it can be profitably used in the manufacturing business. The percentage of increased output in our business we cannot figure at present, but we are satisfied that we are getting much better results than we formerly were able to get by either the piece-work or day-wage systems. We are making a greater output with a lower total pay-roll and are paying more dollars to our individual men. In many instances we have reduced the cost of production one-half, and instances where one-third of the time has been saved are not unusual. We find that it requires a broad-gaged man to properly operate the system, and like anything else where handling men is concerned, narrow-mindedness must be utterly excluded, otherwise neither the company nor the men will derive very much benefit from the system. Having once made a time allowance on a job we never change it."

Manufacturer No. 8—Commercial rating, $10,000 to $20,000; products, drills, small machinery: "So far as we have used the premium plan, we find it very satisfactory indeed. We have been using it since 1890 and fully endorse it. It saves a lot of superintendence. The best men earn the best wages, and there is not the same incentive to deceive the cost clerk in fixing new rates, as there is in straight piece work where adverse circumstances are liable to give a man less than his normal wages. We have found no difficulty in presenting to a man a proposition whereby, by a little extra effort and attention to his work, he can increase his wages by 15 or 20 per cent. We find that the system saves a lot of foremanship. You will find difficulty in introducing the premium system into your

factory for the simple reason that nothing new can be put into any factory without more or less opposition, wonderment and criticism on the part of the employees. Under careful management this dislike for the system will disappear in a very short time, after which its benefits will become apparent and will grow if the factory is properly handled."

Manufacturer No. 9—Commercial rating, $75,000 to $125,000; products, electrical apparatus and fittings: "By using the premium system we find that the cost decreases as the output increases. We have been able to increase the output from 10 to 50 per cent., according to the article and local conditions surrounding its production. The cost of production is considerably decreased by this increased output, but *our greatest advantage gained is the actual increase of the output per unit equipment,* and in the satisfaction which the men have in receiving increased earnings, thereby making it of personal interest to them to exert their efforts in carrying out our interests. Another point of superiority of this system is its *flexibility.* In departments where only a few men are employed, we move them around on different jobs with great ease. This we are able to do because they receive a day wage anyway, and if they are able to make a time allowance they get so much extra, and the shop of course makes a like saving. In this point the premium system is superior to the piece-work system, because in piece-work system one man cannot be shifted around on to different classes of work. It is also superior to the day-wage system, because if one man be shifted on to various classes of work, the cost is very apt to be excessive, particularly as he has no incentive to decrease that cost."

Manufacturer No. 10—Commercial rating, $75,000 to $125,000; products, machinery parts and specialties: "Replying to your inquiry concerning our use of the premium system, we will say that the saving of from 5 to 20 per cent. on previous costs can be shown as due to the operation of this system. A saving has also been made of about 20 per cent. on the pay-roll, a like amount having been added to the wages of the employees. In regard to output, that is where we consider the system the most valuable, as an appreciable number of dollars' worth of machinery has been saved in a few months' time, together with the rental of the building, which would otherwise have been required to accommodate this machinery. The increased output with us has varied from 10 to 300 per cent.; this great range in percentage is due to the varied class of work which we handle, and depends largely upon the size of the pieces and upon the number of operations required to complete any given unit of output. We have found that this system reduces the wear and tear on our equipment, because the men see that they cannot do rapid, accurate work without having their tools and machinery in the best working order. The degree of refinement on this point regulates itself. Cost decreases as output increases. In a nutshell, we find the advantages gained by the use of the system to be: *Greatly increased output, decreased cost per unit production, lower pay-roll and more dollars to the individual workmen."*

The New York Meeting of the American Society of Mechanical Engineers.

The forty-second meeting of the American Society of Mechanical Engineers took place in this city at the society house last week, the first session being called to order by President Morgan, of Worcester, at 9 P. M. Tuesday, the 4th inst. After the usual preliminary announcements, including the dear, familiar one about the necessity of members handing in their railroad certificates, and the more interesting one to the effect that the Locomobile Company of America had placed at the disposal of the society fifteen of its machines, to be used by the members in going about the city at their pleasure, the regular business of the meeting was taken up by the announcement of the names of the tellers of election, after which President Morgan delivered his annual address. Very naturally, this address dealt with the branch of engineering work to which Mr. Morgan has devoted practically his entire life—that is, the improvement and development of rolling-mill processes, especially the rolls themselves and the furnaces in which the heating is done, his earlier and pioneer work having been done mainly in the service of the Washburn & Moen Company, of Worcester. Mr. Morgan reviewed the history of the development of the rolling mill, calling attention to the fact that previous to the time of Henry Cort, an Englishman, who was contemporary with Watt, wrought-iron bars had been produced only by hammering, and that the processes of metallurgy and of heating were very crude and imperfect, as compared with what they were after Mr. Cort had completed his work. He called attention to the very important work done by Cort, to the difficulties he overcame, working in conjunction with Black, the metallurgic chemist, and said that, while Watt's engine gave to humanity a giant that had worked wonders in the service of mankind, the rolling mill had been this giant's club, by which he had brought about the greatest revolution in human affairs; that the railroads which had been used in the development of our western country, and in fact in the furthering of civiliaztion everywhere, would have been impossible without the rolling mill. The development of "continuous" mills was reviewed, the first mill known as "continuous" to be built in this country having been designed by Mr. Morgan in 1859, for use in the Washburn & Moen works. These furnaces have since been developed to such a point that the rod now passes through the rolls so rapidly that in some cases while one end of the ingot is still in the furnace the other end has gone through a succession of rolls and is being wound upon a reel, also of Mr. Morgan's invention; the first roll which receives the ingot from the furnace making in some cases about sixteen turns per minute, while the last roll of the series may make as high as 1,200 turns per minute, the difference in speed, which is gradually graded from one roll to another, being necessitated by the reduction of the diameter and the consequent lengthening of the rod or bar.

At the conclusion of the formal address, some slides of Mr. Morgan's were thrown upon the screen, and he explained by them what the construction and operation of various rolls were and the systems of rolling, including the Belgian, the "continuous" and the "combined"; also the flying shear, by means of which the bar is cut off in any desired lengths as it comes from the rolls and without interfering with its progress. Various types of furnaces were also shown by means of sectional drawings, which were thrown upon the screen, their construction and method of operation explained and questions regarding them answered.

An interesting view was that of the grave of Henry Cort, in Hampstead churchyard, England, the view showing the tombstone over his grave and the inscription upon it, besides which there was a general view of the churchyard in which this tombstone stands.

At the conclusion of the address there was the usual resumption of social intercourse which had begun an hour or so previous to the opening of the formal meeting, and the usual luncheon was served in the dining-room, the members not dispersing until a late hour.

At the first meeting there was the usual crush, both in the reception and dining rooms, and it is becoming clearly evident that something will ere long have to be done to relieve the pressure upon the society's house.

WEDNESDAY MORNING SESSION.

The business of this session was opened by the presentation, in print, of the Annual Report of the Council. Among the more important matters included in the report was that relative to improvements in the heating and ventilating of the society's house, toward which active steps have been taken. As a recognition of the courtesies extended to the society by the British Institution of Mechanical Engineers, the British Institution of Civil Engineers and the Society of Civil Engineers of France, the presidents of those societies have been elected to honorary membership. Mr. John Fritz has also been elected to honorary membership. The second mortgage for $32,000 upon the society's house has been paid off and can-

celled. Financially, the society is in excellent condition.

Following the report of the council, the reports of committees were called for. The Committee on Standards for Electric Generating Sets asked for a postponement until after a conference with a similar committee of the American Institute of Electrical Engineers, which was expected to take place during the afternoon. The Committee on Junior Meetings reported, in outline, the work already done this year as well as that mapped out. The Committee on the Transatlantic Trip of 1900 gave a verbal report, which is to be followed by a written one for incorporation in the Transactions. The Committee on Standard Engine Tests reported that their code was complete, so far as it related to steam-engine tests, but that additional work remained to be done on those portions of the code which related to tests of internal-combustion engines. They expect to make a full report at the spring meeting. The Committee on Standard Pipe Unions also reported progress and expected to make a report at the next meeting. The Committee on the proposed Robert Fulton Memorial reported the subscription, to date, of $1,450, with $250 available from other sources. The subscriptions so far received have come from about 10 per cent. only of the membership. The committee desires to increase the fund to $2,000 before proceeding with the monument.

Following the reports of committees the tellers of election announced the election of the official slate ticket, and retiring President Morgan appointed Ex-Presidents Warner and R. W. Hunt a committee to conduct President-Elect Wellman to the chair.

Following this ceremony, it was announced that during the afternoon the Locomobile Company of America would have a number of automobiles in attendance at the society house for the pleasure of the members, and that on Friday afternoon, at the Adams Express Company's depot, an exhibition of an automobile truck would be made.

The first paper* on the list was then read in abstract by its author. The title was

Comparison of Rules for Calculating the Strength of Steam Boilers.

BY H. DE B. PARSONS.

The object of the paper, which was a short one, was to call attention to the differences in the results obtained from the different rules in use for computing in detail the strength of steam boilers. The rules compared were those of the United States Supervising Inspectors of Steam Vessels, Lloyd's Rules, Board of Trade, British Corporation and the Bureau Veritas. For the working pressure for the shell of a boiler a difference of 25 per cent. was shown under these rules. For the working pressure on the flat heads in the steam space a difference of over 44 per cent. was shown. An appendix gave very concisely the rules or formulas of the five organizations referred to. At the conclusion the author expressed a hope that a committee would be formed to deal with the subject and to formulate some authoritative rules.

In discussion, Mr. Rockwood considered that in this country there was less disposition to follow authorities than in Europe, and that the subject had correspondingly less interest here than there. Nevertheless, he made a motion that the council be requested to take the matter into consideration and to appoint such a committee, if in their judgment advisable.

Mr. Cary thought that such a committee would only add another set of rules to those now existing, and so add to the confusion instead of reducing it. He opposed the appointment of the committee.

Mr. Hale considered it to be almost impossible to formulate a set of rules which would take into account all the factors of the problem.

Professor Spangler thought it largely a matter of insurance. If one wished to insure with a given company he must follow that company's rules; but if he proposed to insure himself, he might follow his own rules.

Mr. Kent called attention to the fact that if the rules of the United States Supervising Inspectors be omitted, the remaining rules agreed fairly well among themselves, and he then proceeded to characterize the rules of the United States Inspectors as entirely inadequate and unworthy of respect, with which sentiment others heartily agreed.

Mr. Snell pointed out that, thanks to rigid inspection, Philadelphia had had but two serious boiler explosions in eight or ten years, although 8,000 or 10,000 boilers were in use in the city. Both of these explosions had been of new and well-made boilers.

At the conclusion of the discussion Mr. Rockwood's motion was carried.

The next paper on the list was on

A Record of the Early Period of High-Speed Engineering.

BY CHAS. T. PORTER.

As we shall print Mr. Porter's paper in full, it is not necessary here to present an abstract of it. The paper was an interesting and valuable contribution to the history of two important and curiously related episodes in the development of modern steam engineering, the improvement and practicalizing of the steam engine indicator and of the high-speed engine, and it was also a manly and appreciative tribute to the work and worth of Mr. Porter's most intimate and helpful collaborator, the late John F. Allen.

When called upon to read his paper, Mr. Porter set an example which it is a pity cannot be made universal, by saying that he desired to *present* the paper, but not to read it.

The paper was discussed at length by Dr. Thurston, who gave many interesting reminiscences of the days which already seem ancient and of the giants who then flourished. He referred to a collection of indicators in the Cornell collections, which, beginning with the Hopkins instrument and coming down to present-day types, is more complete, chronologically, than any other collection. A photograph of this collection was passed around for inspection. The speaker considered that to the influence of Messrs. Porter and Allen a revolution may be attributed, their use—then a novelty—of the highest standards of workmanship in engine construction being largely responsible for their own success and that of their followers.

Mr. Supplee called attention to Mr. Porter's modesty in saying in his paper: "This bed was adopted by the Tangye Brothers, of Birmingham several years afterwards," and considered it a gross injustice that the Porter bed should be generally known as the Tangye bed. Many American engine builders are doing an injustice to their own countryman in calling their beds by Tangye's name.

The concluding paper of the session was entitled:

The Steam Turbine—The Steam Engine of Maximum Simplicity and of Highest Thermal Efficiency.

BY ROBERT H. THURSTON.

This characteristic paper by Prof. Thurston defines, in its opening sentence, the engine indicated in the title as "a machine having a minimum number of moving parts and thermodynamically free from other wastes than those of the ideal thermodynamic machine." While such a machine has never been produced, and never will be, it is asserted that a remarkably close approximation to this ideal is afforded in the most recent developments of the steam turbine. Of the Parsons turbine it is asserted that the computed efficiency, without allowance for wastes, is about 87 per cent. The actual consumption of steam is 16 to 26 pounds per hour per electrical horse-power. Common speeds for the smaller sizes are 15,000 to 20,000 rotations per minute. Dow's turbine is said to have attained 35,000 rotations per minute. The latter it is stated may be built so light as to weigh but 2½ pounds per horse-power. The paper gives an interesting account of the history of the Parsons turbine and then goes into an elaborate discussion of the theory of its action. An account also is given of elaborate experiments with a Laval steam turbine at Sibley College. At the end of the paper are given a series of conclusions arrived at, all quite favorable to the steam turbine for many applications.

The paper was presented in abstract only, and in his remarks the author referred to some information obtained from

*Copies of the papers in full, may be had for a few cents each by addressing the Secretary of the Society, at 12 West 31st street, New York.

Professor Sweet since the paper was written, relative to a Mr. Avery, of Syracuse, N. Y., who in 1835 constructed about fifty steam turbines, which were said to consume about the same amount of steam as the slide-valve engines then in use. The author considers the steam turbine a very promising machine for certain applications, but he does not consider the field in which it has attracted the most attention—marine propulsion—as the one best suited to it.

In the discussion, one speaker referred to its applicability to ice-making machines, because of its requiring no cylinder oil. On this account redistillation of the water would not be necessary.

Mr. Bolton referred to the lack of reversibility of turbines and their loss of efficiency at reduced speeds as serious disadvantages in marine service, and described an arrangement in which the propellers were driven by electric motors which obtained their current from a dynamo driven by a turbine.

Mr. Rockwood considered that the slow progress in the use of the turbines was due to nothing but conservatism, but was interrupted by a member, who asserted the reason why they were not more used, to be that they could not be had. Their excessive cost was also referred to, and Professor Carpenter gave the opinion that the high-class material and workmanship essential to their success would cause them to remain permanently expensive; but to this it was replied that the amount of material was very small, and the bicycle was referred to as a parallel machine, in that it involved high-grade material and workmanship, and yet was sold at a low price.

At the conclusion of the session a letter was read from the president of the Engineers' Club, extending the courtesies of the club to the visiting members.

WEDNESDAY EVENING SESSION.

This session was opened by a short paper, entitled:

Note on Centrifugal Fans for Cupolas and Forges.

BY WILLIAM SANGSTER.

This paper opened with the statement that in hardly any other class of machinery is the method of application of so great importance as with centrifugal fans, and it then proceeded to offer several formulas for computing the power required for fans in cupola and forge practice. Cupola fans, forge fans and smoke exhausters were treated separately, and the relation of outlet pressure to outlet area also was made a subject of computation. The ratio of outlet to inlet of a fan should be so proportioned that the air will enter with the least possible velocity. The total horse-power input to a fan is the sum of the horse-powers at inlet and at outlet plus the power lost in friction, belting, etc. The loss of power increases rapidly with the increased ratio of outlet to inlet areas, and with the areas equal as much work will be expended in drawing the air in as in expelling it.

In presenting the paper in abstract, the author explained that the formulas were intended to give approximations which should be sufficiently accurate for most purposes. He also added a few words about overloaded fans. If a fan will not give quite enough air, it is a very natural expedient to increase its speed; but this was condemned as excessively wasteful of power.

The paper was discussed by Mr. Snell, who thought the data on which it was based not sufficiently reliable. He then explained a diagram which he had drawn on the blackboard, which exhibited the results of a measurement of the volume and pressure of air supplied to a cupola. This he said was the only test of the kind of which he had knowledge. He also thought that the author's allowance of 4 ounces pressure for forges excessive. If the tuyeres had sufficient area of opening, he considered 2 ounces sufficient.

Following this came a paper on

The Power Plant of the Massachusetts General Hospital.

BY F. W. DEAN.

Mr. Dean was incited to the preparation of this paper by that of Mr. Kerr, at the meeting a year ago, describing the plant of the South Terminal Station, Boston. The plant here described is for the combined service of two separate institutions. These occupy the extremes of a long piece of property, and the natural location for the heating and lighting plant would have been in the middle, but what contributes to the interest of this plant is that for good reasons it was placed at the extreme end. Vertical boilers were used to economize space, and a good hint for all as to the smokeless consumption of coal is afforded in the fact that the crown sheets of the boilers were placed 8 feet above the grates, smoke being rarely seen, and then but slightly. The piping and other details are spoken of and the engines with the treatment of the exhaust steam, oil separators and other appurtenances. The voltage employed was 220, and a number of considerations were enumerated in defence of the practice. It was stated that the economical result of the installation as a whole was most satisfactory, this new plant for two institutions, with a large increase in the lighting of one of them, consuming only the same coal as was formerly used for one, thus saving the interest on $150,000, while the cost of this plant was only about one-half of that amount.

The paper provoked a very animated and, in the main, appreciative discussion. Some rather sharp criticisms of certain features were made, but they were largely answered by other speakers. Mr. Bolton questioned the need of any pipe tunnel. If the pipe lines were properly put together, he did not consider access to them necessary.

The next paper on the list was on

The Construction of Contracts.

BY R. P. BOLTON.

The contracts here referred to more particularly are those drawn up between the owner and the contractor for a contemplated building. The author gives a copy of the "Uniform Contract," which has been adopted by the Institute of Architects and the National Association of Builders. This he proceeds to criticise, article by article, first, however, giving the general opinion that it is a very lame and amateurish affair. He points out both ambiguous and unjust provisions, and concludes with a statement of certain provisos which should properly be included in such a contract.

This paper also received a very full discussion, and from the points of view of different parties to contracts. Most of the sentiments expressed were in sympathy with those of the author, though it was felt, as one speaker expressed it, that "the author had brought a good cause to the wrong court"—that is, to one that had no jurisdiction in the case. The "Uniform Contract" was denounced by all, and architects in general came in for a round of denunciation for many of their practices.

Mr. Walworth, who spoke as a contractor, and obviously from a large fund of experience, felt obliged to the author for having reopened the subject, but considered that the proposed contract was altogether too long and detailed. He favored the utmost simplicity in contracts, and related cases in which the attempt to go too far into details had brought about the very difficulties which it had been the aim to avoid.

The concluding paper of the evening was entitled:

An American Central Valve Engine.

BY E. T. ADAMS.

In this paper attention is first called to the fact that the essential feature of the central valve engine is a very old one, and a tribute is then paid to the excellence of the Willans engine, it being stated that sales of it have been made aggregating 320,000 horse-power. As the Willans engine has not attained in this country the popularity reached in England, the opportunity was availed of to design, in somewhat different form, an engine embodying the original central valve idea, and this engine the paper professes to describe. The description, however, is merely a brief argument in favor of the chief characteristics of the engine spoken of, and a slight description of the valve gear. It is assumed that a desirable engine for large field of employment should be one of moderate speed, a vertical engine to require small floor space, single acting to reduce the hight, a central valve to allow ample port opening, low clearance and perfect drainage, and it should be compound if the gain in economy justifies the ex-

pense. The American central valve engine is said to satisfy the conditions assumed. The governing is a combination of throttling with variable cut-off. The concluding paragraph of the paper has these remarks concerning the simple automatic engine in common use: "The time has come when it should be radically changed or replaced by something better. In every essential part, save only in regulation, it fails to satisfy the conditions with which it is confronted. Its steam consumption in the cylinder is perhaps moderate enough, but the leakage direct to the exhaust is enormous. Its first cost is perhaps low enough, but its cost at the end of ten years is beyond all reason."

A written discussion was presented by Dr. Thurston, who paid a warm trubute to Mr. Willans. He remarked that the merits of the vertical engine for stationary service were only now coming to be recognized.

Mr. Scheffler complained of the meagreness of details in the paper, and hoped the author would expand it before its final publication.

THURSDAY MORNING SESSION.

The program had announced that Thursday would be spent at Columbia University—the morning in the reading of papers and the afternoon in viewing the equipment of the Mechanical Engineering Department. Accordingly, the members assembled in the morning in the large lecture room of Havemeyer Hall, the first paper of the session being a description of

A Mechanical Integrator used in Connection with a Spring Dynamometer.

BY MAX H. WICKHORST.

This paper very briefly described an instrument designed by the author and used in the dynamometer car of the Chicago, Burlington & Quincy Railroad. The integrator consists of a registering wheel sliding back and forth coincidently with the movements of the dynamometer springs, and a circular disk, making in this case three revolutions to the mile, on which the registering wheel slides. When there is no compression of the springs, the wheel stands on the center of the disk. The farther the wheel gets from the center of the disk, as the spring tension increases, the greater will be the number of its revolutions. Although the paper was very short, it showed the instrument and its operation quite clearly.

The leading discussion of the paper was by Mr. Snow, who complained that the paper was deficient in information regarding the interpretation of the records, and proceeded to give his own methods of doing this.

The next paper to be taken up was a description of an

Apparatus for Dynamically Testing Steam Engine Indicators.

BY C. A. READ.

The apparatus here described is an outgrowth of an old form of indicator testing apparatus in which the steam was turned on and off several times, and finally, with the steam on, a line was drawn on the card, the pressure being observed at the same time.

In this operation a three-way cock is used to turn the steam on and off. The cock is turned by a small countershaft fitted with cone pulleys for varying the speed, and the drum is worked by a crank-arm attached to the cock. A Crosby gage tester is used to measure the pressure accurately. The apparatus eliminates the question of the temperature of the spring, the sluggishness of ordinary methods and all personal errors, except that due to the manipulation of the gage tester.

In the discussion, Professor Jacobus remarked that the steam should not be kept turned on for too long a time, and that the three-way cock should be absolutely tight.

Mr. Rice described a slight change in the three-way cock which adapted it better to high speeds, and continued by saying that while much had been said and written about the testing of indicators, but little had been said about the methods of allowing for the errors after they were determined.

This brought Professor Jacobus to his feet again, who explained his method for allowing for an irregular pressure scale. He also said that there was no way of allowing for friction in the instrument. When testing indicators he pressed the pencil mechanism alternately up and down with his finger at each test pressure applied. The pencil should come back to the same point after each application of the finger, and if it did this the error due to friction in the instrument might fairly be regarded as negligible.

Following this came a paper describing

A New Recording Air Pyrometer.

BY WM. H. BRISTOL.

The instrument described in this paper is essentially an air thermometer. A porcelain bulb, partly exhausted of air, projects into the furnace and by a capillary connecting tube is made to act on a modified Bourdon tube or spring. A second Bourdon tube is not connected to the porcelain bulb, but is so attached to the first tube that the influence of changes in atmospheric temperature and pressure acts in opposite directions on the two tubes, and the instrument is thus made self-compensating for these changes. A revolving paper dial driven by clockwork, similar to that familiar in the Bristol recording pressure gages, completes the instrument.

The author had two of his instruments present, with a glass jar or "receiver" fitted to enclose one of them, while an air pump exhausted the air from the receiver, and thus showed the perfection of the compensation for changes in the barometric pressure. The second instrument was without the compensation, and a similar test applied to it showed the need of the compensating arrangement. By immersing the Bourdon tubes in baths of water at different temperatures the adjustment for changing temperature was likewise shown.

A high degree of interest was manifested in the discussion, which took the form of a running fire of questions, to which the author replied. The chief anxiety of the questioners was to know to how high temperatures the instrument could be applied. To this the author replied that he had had experience with it up to about 2,200 degrees Fahr. He saw no reason why it should not be successful up to 3,000 degrees, but could not speak positively as yet. The determining factor was the temperature at which the glaze on the porcelain bulb would give way and admit air. Mr. Henning gave some reassuring information on this point by saying that such bulbs were used in Europe, and were very durable there. Mr. Trump said he had used such tubes for temperatures up to 3,000 degrees Centigrade, though there was some doubt as to his meaning.

The concluding paper of the session was entitled:

Comparative Value of Different Arrangements of Suction Air Chambers on Pumps.

BY T. M. WHEELER.

The author of this paper introduced a variation from the usual and generally preferred practice by reading his paper entire.

Mr. Wheeler insists that if noise is to be avoided, an air chamber is just as necessary on the suction as the discharge side of the pump. He describes faulty and effective arrangements of such air chamber and gives indicator cards from pumps with and without such chambers.

At the conclusion of the reading of Mr. Wheeler's paper, President Low, of Columbia University, was introduced and welcomed the society to the university in well-chosen words, after which President Morgan, who presided, called upon Ex-President Thurston for a reply, which was made in equally well-chosen words.

The discussion of the paper was then taken up. Mr. McBride thought too much stress had been put on the location of the air vessel and too little on its size. Several asked for rules for the size of the vessel, but these the author was unable to give. The difficulty was to get people to use them at all, and he was devoting his attention to this.

FRIDAY MORNING SESSION.

At this session the society re-convened at its house, the first paper presented being entitled

Tests of the Boiler of the Purdue Locomotive.

BY W. F. M. GOSS.

The tests reported in this paper were run immediately after the re-establishment of the Purdue locomotive testing plant after its destruction by fire in 1894. The tests are thirty-five in number and the results are given in numerous tables and diagrams. The paper is too voluminous

to summarize further than to say that the various tables and diagrams show the quality of the steam at different rates of evaporation, the rate of combustion, the thermal units absorbed, the evaporative performance, the relation between the coal consumed per square foot of grate per hour, the draught and the smoke-box temperature; between the pounds of water per square foot of heating surface per hour, the draught and the smoke-box temperature; between the rate of evaporation and the efficiency; between the rates of combustion and evaporation and between the rate of combustion and the efficiency. Formulas for the performance of the boiler are also derived from the experiments.

We believe that no such thorough set of tests of locomotive boilers has ever before been made, and, in fact, facilities for making them do not exist except at the Purdue and the Chicago & Northwestern Railway plants.

In the discussion, Mr. Hale compared the results of the paper with theory and with Rankine's formulas. He was disposed to criticise the experiments as incomplete and thought a few complete experiments of much greater value than many incomplete ones. Mr. Kent spoke in somewhat the same vein, saying that in any scientific boiler test he considered it necessary to measure the air supply and to take observations on the fire-box temperature. Mr. Wagner considered that the numerical factors given would vary with the engine under test as well as with the coal used. He also considered that the sampling of the steam for tests of dryness should be made at or near the steam chest instead of the steam dome. If the steam was wiredrawn some change between dome and chest was certain. Mr. Scheffler considered the conditions of the locomotive when at rest to be more favorable to dry steam than when in motion on the road, and other speakers thought this difference of conditions might be important. Mr. Soule considered the paper useful in the highest degree. The data given were both unique and invaluable. His only criticism was that the author had kept the results so long before publication. In his reply Professor Goss said that a locomotive in a testing plant vibrated much more than might be expected, and he thought the difference in conditions in this respect not sufficient to seriously affect the results. The tests described were really preliminary to others which would be published in due time.

Following this paper came one entitled

Tests of Centrifugal Pumps.

W. B. GREGORY.

The pumps of which the tests are reported in this paper are of two sizes. The small one is of 2½ inches suction and discharge bushed to 2 inches. This pump was tested in the laboratory. The results are given in diagrams which show a very pronounced point of maximum efficiency occurring at a certain head for each velocity.

The large pump is part of the drainage system of New Orleans. It has a discharge pipe of 52 inches diameter and two suction pipes of 36 inches diameter each.

In the discussion Mr. Webber considered that the experiments proved their own inaccuracy by the fact that some of the curves in which the experiments were plotted sloped the wrong way. He and other speakers had very little faith in the Pitot tube, which had been used to measure the discharge of the large pump. The discharge tube of the larger pump did not run full—a condition which is fatal to efficiency in a centrifugal pump. Mr. Adams considered that the figures for efficiency were absurdly low. Efficiencies of 70 and even 80 per cent. could now be had with centrifugal pumps and this regardless of the head. He could only account for the low efficiency by assuming a large leakage of air on the suction side of the pump. He considered the methods of conducting the test to be seriously at fault. Fuller analysis and more complete data were needed to enable the reader to judge of the value of the tests. The method of finding the friction head he considered entirely wrong. Other speakers spoke in much the same vein, the discussion being closed by Mr. Kent, who criticised the mathematics of the paper.

The next paper to be taken up was on the

Hardness, or the Workability of Metals.

BY W. J. KEEP.

The author of the paper, who is superintendent of a very large stove works, has developed a system of making physical tests of cast iron, which system we have already described. In this paper he describes a new form of machine for testing the workability (rather than the hardness) of metal specimens. At the start he states that a test of workability such as his machine makes will not distinguish between hardness, which blunts a tool, and tenacity, which makes it difficult for a tool to remove a portion of the material. After referring to the work of others, particularly the Bauer machine, which was first made public in these columns, he describes his own machine in which the drill points upward, and the work with the weights which produce the required pressure are in effect suspended upon the point of the drill. Thus arranged the chips fall away from the point of the drill as they are made, and if a chemical analysis is to be made can be caught in a receptacle provided for the purpose. An apparatus is attached to the machine which makes a diagram somewhat similar to that made by the machine built at the works of Ldw. Loewe & Co., of Berlin, and which we showed at page 856. The author gives some results obtained with the machine, which we do not give, as we shall shortly publish the paper, and when we do, will print a half-tone of it, from which the construction of the machine can be understood, which is much more than can be said for the engraving published by the society as part of the paper.

In the discussion, Mr. Thos. D. West considered the hardness test as inapplicable to pig iron. He submitted samples of pigs which, when thus tested, gave very different results, but which, in point of fact, made castings which were nearly identical in workability. Mr. Bacon did not consider the test as a good one, because the drill of necessity penetrated to considerable depth, the most of the record being made when drilling iron in the interior where it is comparatively soft. The iron actually cut in machining a casting is necessarily near the surface, and he considered that a satisfactory test would have to be applied to the same surface metal.

Following this came a paper on

A New Principle in Gas-Engine Design.

BY C. E. SARGENT.

This paper presents a radical innovation in gas-engine design, and one which, if the author's conclusions be verified by extended experience, may lead to important results.

The starting point of his design is the abandonment of the hit-and-miss method of governing. He governs by the control of the admission, but not by throttling, as in some designs. The explosive mixture is admitted freely, but not for the entire length of the stroke. At a point of the stroke determined by the governor, and not later than one-half stroke, the explosive mixture is cut off and beyond that point is expanded to the end of the stroke. On the return stroke it is compressed, reaching the original pressure as the point of cut-off is found, and beyond that point it is compressed as in the usual engine. From this innovation some remarkable results follow. First the charge after ignition is expanded to at least twice its original volume, with a resulting addition of twenty to twenty-five per cent. to the area of the indicator card at full stroke. Second, the pressure and temperature at exhaust are reduced, making the exhaust less noisy, and, what is still more important, reducing the average temperature in the cylinder. This the author states is sufficient to permit the successful use of a piston rod and stuffing box—the latter being water-jacketed. On this hinges an entire reconstruction of the engine. Not only is this engine made double-acting, but two tandem cylinders are used. Each end of each cylinder gives an impulse at every other revolution, the final result being an impulse at every stroke, as in an ordinary steam engine.

Still another use is made of the cut-off feature of the admission to provide a starting device. The engine being turned by hand until the point of cut-off is passed, the charge is immediately fired, an impulse

being thus given which is sufficient to start the engine. While being thus started, the action is similar to that of the old Lenoir engine. The change from the Otto to the Lenoir cycle is made by the simple movement of a lever. The lower compression accompanying a light load and early cut-off requires a corresponding advance to the igniter, and this is provided in the design.

The author considers the engine to be more economical than others at both full and part load, and to have increased range of load within which it will operate. No exhaustive tests have been made to determine these points, but the author hopes to present the results of such tests at the next meeting of the society.

The hour of adjournment was now approaching and the discussions became briefer. It was stated that the cycle here used had been suggested and tried before. One speaker who had seen the engine at work spoke in the highest terms of it and mentioned as one of the highly ingenious devices incorporated in it the stuffing-box packing, which was made of simple lead pipe perforated and filled with plumbago, which was squeezed out as the pipe was closed up by the gland.

The two remaining papers on the list were read by title only, and some contributed discussion on them was not read, but will appear in the printed Transactions. There was no oral discussion. The first of these papers was on the

Heat Efficiency of a Gas Engine as Modified by Point of Ignition.

BY C. W. KERR.

We have here a series of tests undertaken at the Armour Institute of Technology on a Fairbanks-Morse gas engine of 7-brake horse-power controlled by a centrifugal governor acting on the hit-and-miss principle. The engine was fitted with a mechanically operated electric igniter so arranged that it could be adjusted to produce a spark for any piston position between 4½ inches before the end of the stroke and an equal distance after it. Tests were made at brake loads of 0, 2½ and 5 horse-powers. The paper concludes with sample indicator cards and a summary of the tests in both tabular and graphic form.

The next and last paper of the list, which was also read by title only, was entitled

Power and Light for Machine Shop and Foundry.

BY FORREST R. JONES.

This paper is a statement of the conditions surrounding the installation of electric plants for lighting and driving two establishments, together with the considerations which led to the adoption of the type of machinery eventually installed. The author favors direct current machinery for this purpose and adopted the multiple voltage arrangement. Results of tests of several machines, undertaken in order to determine the necessary capacity of the generators, are also given. Such considerations as those given are essential in all such cases if satisfactory results are to be obtained, and the paper should prove useful to those having such work to do. Even if the conclusions arrived at should not be applicable to other conditions, the paper will at least show what considerations must be kept in mind in order to arrive at just conclusions.

Following this came the usual resolutions of thanks to those whose hospitality had been extended to the members, after which the meeting adjourned.

In point of attendance the meeting surpassed all records, the total registered attendance being 760.

One feature of the meeting which received much favorable comment was the reading of most of the papers by abstract only. The reading of papers in full has been a cause of wonderment by many in the past, and it is to be hoped that the plan inaugurated at this meeting will be made permanent.

Features of the Columbia University Session.

This meeting of the Society at Columbia University was a most decided success in every way. The attendance was much larger than was expected and there was every indication that the innovation (of leaving the society's house for a session elsewhere) was very well received.

Prof. Hutton in his introductory remarks explained something of the situation of the university and of the college of mechanical engineering which now forms a part of it, stating, among other things, that the university is about $1,000,000 in debt, and for that reason the university authorities would not appropriate money for extraordinary expenses in the newer departments, such as for the purchase of mechanical laboratory equipment, for instance, until the university as a whole was in better financial condition. The university did, however, undertake the expense for installation of machinery and apparatus donated to the laboratories, and in the case of the Vauclain compound locomotive given by the Baldwin Locomotive Works it was stated that its installation had cost the university about $10,000. Its driving wheels rest upon the wheels of an Alden automatic absorption dynamometer (described and illustrated in our issue of June 19, 1890) by means of which the entire power of over 1,000 horse-power developed by the engine may be absorbed and the resulting tractive effort measured at the drawbar.

President Low's address, although brief and delivered practically on the spur of the moment, was a model in its way and made the members feel that though here was a man whose education and life work had been along entirely different lines he nevertheless fully appreciated the importance and the high character of the work done by mechanical engineers. Indeed he said that he felt not only at liberty but in a secure sense delegated, to extend to the members the heartiest welcome from every scholar connected with the university, and he believed that all of them realized that the highest positions in any and every branch of scholarship were attained only by a full recognition of and the highest respect for the work done by and the attainments of others who worked along other lines.

At the conclusion of the regular session, President Low received the members in one of the rooms of Columbia's magnificent new library building in which room are kept the old iron crown and the original charter granted by King George II, relics of colonial days. Here, too, in a fireplace is an old cornerstone with a Latin inscription.

Previous to and after the discussion of an excellent luncheon, the members inspected at pleasure the interesting features of the engineering building, wherein are located the class and lecture rooms, drafting rooms and laboratories, etc., used in connection with the work in civil, mining and mechanical engineering. The locomotive already referred to, the Corliss engines donated by the Messrs. Allis of Milwaukee, sons of Edwin P. Allis, especially attracted attention, and the splendid power plant, gymnasium and workshops of the Teachers' College were also appreciatively inspected. Of the last named shops, especially that devoted to instruction in machine-shop manipulations, it is well within bounds to say that they are much less like "mechanical laboratories" and much more like well-conducted commercial machine shops than it is usual to find educational shops, due perhaps mainly to the fact that the Instructor in Metal Working, C. P. Benns, served a regular apprenticeship in the establishment of Warner & Swasey, at Cleveland, after completing his course in mechanical engineering at Stevens' Institute, and is a finished workman and an appreciative student of machine-shop processes as well as a graduate mechanical engineer. He believes in running such a shop as nearly like the commercial shop as possible, in using the modern tools now being used in machine shops and in keeping those who handle them up to something like the standards that would be required of them if they were working in a shop outside of a school. Accordingly we find here, for instance, a Hartness flat turret lathe, and find it being used in such a manner as not merely to teach its movements but to show what it is capable of. It is well equipped with good tools that *cut* under a flood of good lard oil and the machine is fairly worked instead of being merely dallied with, and this is characteristic of the shop throughout.

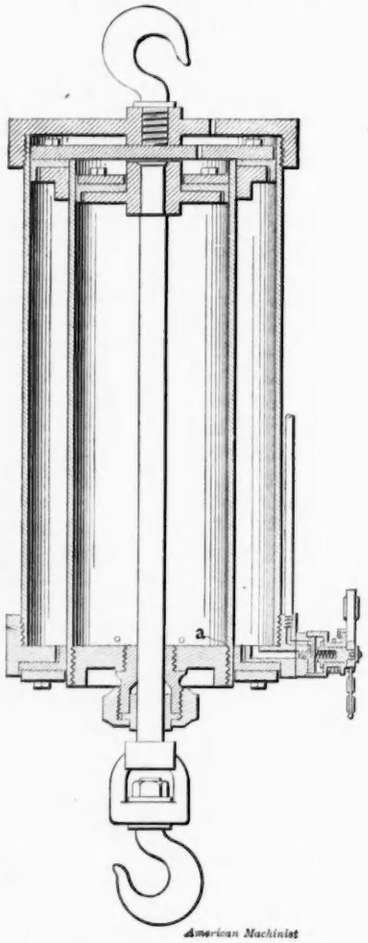
Inquiry for Machinery.

(137) Wanted names and addresses of manufacturers of a belt-driven hammer suitable for beating aluminum leaf.

Some New Things.

A PNEUMATIC FRET-SAW.

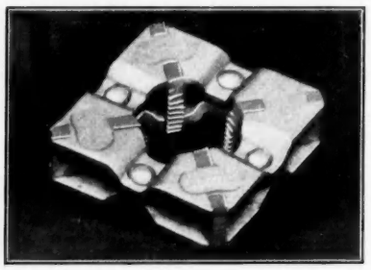
There has recently been made a new and interesting application of the pneumatic tool. This is a fret-saw directly attached to the piston of a pneumatic hammer and making from 1,000 to ,800 strokes per minute. The saw is an ordinary key-hole saw blade, and it may be made to follow the most difficult lines, of course cutting rapidly. Besides the evident use of the tool for the patternmaker and the cabinetmaker, it may be noted that it is in use in one of the largest packing houses in Chicago, for sawing ham bones, using a special saw with very fine teeth. This device has recently been brought out by the Chicago Pneumatic Tool Company.



A TELESCOPIC AIR LIFT.

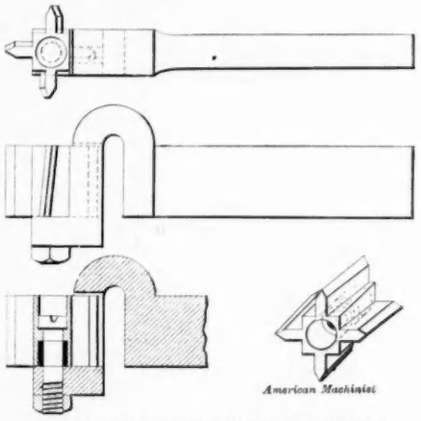
The cut shows a recently patented air hoist which may be found serviceable in some special situations where a considerable vertical lift is required with only a limited space in which to move. A specially designed valve is used in connection with the hoist, but this it is not necessary to describe, as any valve may be used which will admit compressed air from the service pipe for hoisting and discharge to the atmosphere for lowering, accordingly as the valve is moved in one direction or the other.

As will be seen, the arrangement consists of one cylinder moving within another, with a piston in the inside one and a rod passing down through a central stuffing box for hoisting. Obviously more cylinders, one within the other, might be used if a greater vertical travel was required. The cut shows both the inner cylinder and the piston within it at the upper limit of their travel, and sustained in that position, we may assume, by a pressure of air. The area enclosed between the inside of the outer cylinder and the outside of the inner cylinder is somewhat greater than the internal area of the inner cylinder, so that in hoisting the inner cylinder will always be hoisted to the top before the piston within it begins to rise. In lowering, this movement is reversed, the piston first descending and then the cylinder. This is necessary because there is no air passage to or from the interior of the inner cylinder except when it is up, and then holes *a* at the bottom are uncovered. With the parts in the position shown, if the valve is gently opened and the air permitted to escape slowly from the outer chamber, it will also pass out from under the piston, and the piston will descend, and when the piston reaches the bottom its cylinder will then begin to descend, if the discharge of air continues. For hoisting, as there must be no pressure above to resist the pressure below, vent holes are provided in the upper heads of both cylinders. Leather packing is used at the top against the inner surface of the outer cylinder and at the bottom against the outer surface of the inner cylinder, and also for the piston inside the small cylinder. The inventors are Charles O. Bulock and Bertram C. Donnelly, Milwaukee, Wis.



A NEW PIPE-THREADING DIE.

The die shown in the half-tone, which leaves little to explain as to the construction of it, is an instructing one from many points of view. The design of it is novel and ingenious, and much inventive skill must have been employed, not only upon the die itself, but perhaps more so upon the means for its accurate and reliable production. The die is necessarily the product of a factory having a large business in this special line to warrant the expense involved in the preparation and equipment for its manufacture, and it is not one that the little shop will ever be likely to make singly for itself. The die when all is ready for its production is evidently a cheaply made one, and one therefore which can be sold cheaply, which does not in the least detract from its operative efficiency. The cutters are such a small portion of the whole that there is little temptation to use cheap steel, and we are assured that the best steel procurable is used for them. The cutters in their finished shape are also in the best condition for proper hardening and tempering, as they may be heated with the greatest uniformity and also cooled as desired, which cannot be done as well in the case of solid dies. The makers employ a special process for the tempering which they claim secures great wearing qualities. The dies being accurately machined, and also the homogeneous steel plates which hold them, when the latter are riveted together the cutters are securely and accurately held, and the correct cutting size of the die is guaranteed. The die is made by F. E. Wells & Son, Greenfield, Mass.



A LATHE TOOL WITH RENEWABLE POINTS.

The cut shows a recently patented lathe tool suggested to be useful especially for cutting V threads, where the point of the tool requires frequent renewal. The cutter employed in this case has eight points, which may each be used and worn before the cutter is reground, the grinding when necessary consisting only in grinding off the ends or faces, which may be repeated until the tool is all used up. The tool is shown in perspective in the lower right-hand corner. It stands upon the flat projection on the front of the holder, one of the sides of the square part fitting against the upright front of the holder, and the rear cutting point projecting back into a slot in the holder. When the four cutting sides on the top of the cutter have all been used, it is turned over and then the other four come into service, when all the faces may be ground. It will be seen that the cutter is counterbored from each side, leaving a shoulder in the middle for the head of the center bolt. It may be used with a straight central hole, and the bolt may have a head that will lap over the top. The cutter, it will be seen, is expensive to make, but its cost must of course be compared with that of eight single-pointed tools. The inventor is Fernando O. Jaques, Jr., Providence, R. I.

Crystalline Fractures of Wrought Iron and Steel Often Deceptive.

Professor J. B. Johnson, in "Sparks from the Crescent Anvil," calls attention, as has been done before in our columns, to the differences in the fracture of wrought iron or steel, according to the different conditions under which the rupture occurs. All wrought iron, he says, when broken with extreme suddenness, will show a crystalline fracture. This is because time is not given for the drawing out of the section, rupture occurring directly across the fibers, so that the fracture shows only the end view of the same.

When a bar is nicked with a sharp chisel, or grooved in a lathe with a sharp-pointed tool and broken across, rupture begins at one side, without any elongation of the fibers and extends from fiber to fiber across the section in such a way as to produce a result similiar to that caused by instantaneous rupture.

In this way wrought iron will often show a crystalline or granular fracture when, under ordinary tensile tests, it would be wholly fibrous.

All steel or ingot metal will always show a crystalline fracture when treated in this manner, although for the soft and medium grades of steel the fracture is always fibrous or silky when broken in tension, with the usual accompanying elongation and contraction.

When wrought iron breaks in service, therefore, and shows a coarsely crystalline fracture, it does not prove to my mind that crystallization has occurred in service. It proves only that this iron had such a structure originally.

If, however, the rupture occurs in practice in a suddenly contracted area, as in a screw thread, or in a sharp angle, or if it has been produced with extreme suddenness, as in the case of an explosion or shock of any kind, if the appearance of the fracture is finely crystalline or granular, this appearance may be wholly due to the method of failure.

This is shown by the fact that if a specimen be cut from the adjoining metal and tested in tension with the standard form of specimen, it may show a wholly fibrous fracture.

In such case, therefore, the crystalline appearance of the fracture is due to the particular conditions as to shape of specimen and suddenness of rupture and not to any molecular change which has taken place in the iron.

New Catalogs.

"Salaried Positions for Learners" is the title of the latest pamphlet setting forth the aims and methods of the International Correspondence Schools, Scranton, Pa. It is 6x9 inches, standard size.

We have received from the Hollands Manufacturing Company, Erie, Pa., a catalog of improved planer chucks, machinists', pattern-makers', pipe-fitters' and special vises, pipe wrenches, stocks and dies, emery-wheel dresser, natural gas burners of various sorts, etc. Size, 4½x6¼ inches.

We have received a catalog of the Direct Separator Company, Syracuse, N. Y., manufacturer of steam, oil, ammonia and marine boiler separators and of the direct exhaust head, patented by Prof. John E. Sweet. The New York agent is J. M. Duncan, 30 Cortlandt street. This pamphlet is of standard size, 9x6 inches.

The Broadbooks Tool Company, Batavia, N. Y., publishes a little pamphlet showing some tools it makes, including a combination post and bench drill and a combination vise, drill, clamp, etc., which can be adapted as a vise, pipe vise, bench drill, brace drill, double or single-headed clamp, or wagon jack. Size, small standard, 3½x6 inches.

We note the receipt from the C. W. Hunt Company, West New Brighton, Staten Island, N. Y., of its Catalog No. 0011, devoted to the Hunt noiseless conveyor and other machinery for handling coal, ashes and similar materials in power stations. In some of the figures are shown the arrangements of a number of plants installed at home and abroad. Size, 6¾x9¼ inches.

We have received from James Beggs & Co., 9 Dey street, New York, a pamphlet describing the Potter mesh separator and superheater for steam. The firm named have made arrangements to act as sole agents of the F. D. Potter Company for the sale of these separators in this and all other countries, except Great Britain. The pamphlet is 4¼x9 inches, folded.

We have received from August Mietz, 128-138 Mott street, New York, a catalog of the Mietz & Weiss engines operated by gas or kerosene. It is illustrated with line cuts showing how these engines are made and arranged and half-tones depicting them set up for running wood-working machinery, sewing machines, electric generators, etc. Size, 8½x5¾ inches.

The Pittsburgh Shear Knife & Machine Company, Forty-seventh street and Allegheny Valley Railroad, Pittsburgh, Pa., manufacturer of steam and pneumatic hammers of all kinds, punches, shears, rolling-mill and special machinery, has sent us a catalog of some of its single-frame steam hammers. Included are some practical points upon their manipulation. Size, 5½x7 inches.

Another of the attractive Westinghouse publications has been brought out for Westinghouse, Church, Kerr & Co., engineers, Pittsburgh, Pa. It is devoted to the steam loop and Holly gravity return system. Besides a description of the system, the pamphlet contains numerous views of plants where it is installed, including the works of the Brown & Sharpe Manufacturing Company. Size, standard, 9x6 inches.

The Philadelphia Pneumatic Tool Company, Stephen Girard Building, Philadelphia, Pa., has sent us a number of circulars, equivalent to a catalog, of some of their products. We note among these, hammers for chipping, calking and riveting, a pneumatic holder-on, rotary drills and a pneumatic rammer, made either in a hand size for general foundry work or larger to be used suspended from a crane. Some reaemrs are listed. Most of these leaflets are 8x10½ inches.

An imposing publication is the catalog of the Berlin Machine Works, manufacturers of wood-working machinery. It is filled with descriptions and large illustrations of the company's machines, varied with a few views of its plant at Beloit, Wis. Among the machines displayed are sanders, timber planers and sizers, numerous planers and matchers, inside molders, surfacers, cabinet finishing planers, buzz planers, shapers, glue jointers and saw tables. The catalog is printed on heavy paper, and is 13½x10½ inches in size.

The Fishkill Landing Machine Company, Fishkill-on-the-Hudson, N. Y., has published a catalog of its Corliss engines. The different features of these engines, both simple and compound, such as the releasing valve gear, the automatic safety stop motion and the differential vacuum dash-pot, are fully described, the descriptions being aided by wax cuts as well as half-tone views of the assembled engines. The tabulated list of dimensions of these engines shows cylinders, ranging from 10x24 to 30x60 inches. There is a long list of firms and companies cited for reference. Size, 7x9¾ inches.

"Construction and Use of Grinding Machines" is the name of the latest catalog of the Landis Tool Company, Waynesboro, Pa., maker of universal and plain grinding machines for cylindrical, conical and plain surface work. The numerous patterns of grinding machines and attachments made by the Landis Company are here described with no little particularity, which is helped out with reproductions of line drawings of details, countershafting arrangements, etc. Directions for the care and use of grinding machines form part of the attraction of the book, which is printed on heavy paper and gives an impression of substantiality. Size, 6x9 inches, standard.

A trade publication of some interest is a catalog published in English for the London house of Ludwig Loewe & Co., of Berlin, which is in charge of H. F. L. Orcutt, 30 and 32 Farringdon road, London, E. C. Among the general types of tools here described are lathes, milling machines, gear cutters, upright and radial drills, shapers, turret lathes, screw machines, automatic pin and stud machines, horizontal barrel and spindle drilling machines, cutter grinders, cutters, reamers, gages, etc. The line of milling machines is especially large. The book is bound in cloth, is well printed on highly glazed paper, and was evidently translated or written by someone who knows English. To behold this catalog of American-model, German-built tools, printed in English for an English-speaking clientage, gives one the feeling that we are entering an era of upside-downs. The book is 5x7¾ inches in size and contains 186 pages.

Manufacturers.

The Pottstown (Pa.) Manufacturing Company will build an addition to its plant.

The Cornwall (Ont.) Milling Company's flour mill has been completely destroyed by fire.

Ranno & Son, manufacturers of harness, Manchester, N. H., are extending their factory.

John Brennan & Co., boiler manufacturers, Detroit, Mich., will build an addition, 100x300 feet.

Luke Brothers, manufacturers of crates, will build a new handle factory in Fredonia, N. Y.

A large smith shop will be built at 211 De Lancey street, Philadelphia, Pa., for J. J. Martin.

The Milwaukee (Wis.) Gas Light Company will erect a new plant to cost $1,500,000 or upwards.

The architectural iron works of Geo. L. Mesker & Co., Evansville, Ill., were burned December 5.

The Michigan Elm Rope Company has commenced the erection of a $20,000 factory at Grand Rapids.

The Armour Packing Company, Kansas City, Mo., will erect a refrigerating plant at Columbia, S. C.

The Auger & Simon Silk Dyeing Company, Paterson, N. J., will erect a large establishment at Allentown, Pa.

The woolen mills of Balbian Brothers, Tiffin, O., were burned the night of November 25, but will be rebuilt.

Cabel L. McKee has taken out a permit for the erection of a four-story brick factory, 43x117, in Columbus, O.

Montgomery, Ward & Co., Chicago, Ill., will have erected extensive manufacturing buildings at Chicago Heights.

The manufacturing plant of F. Philips, on Glenside avenue and Fourth street, Philadelphia, Pa., will be extended.

The Avalon Knitwear Company (capital, $50,000) has just been incorporated and will locate a plant in Utica, N. Y.

Fire in W. P. Hale & Co.'s grain mill at Providence, R. I., December 1, did considerable damage to the machinery.

Morrell & Morley will build a brick factory at Benton Harbor, Mich., for tin manufacturing, involving an outlay of $30,000.

The plant of the Elaterite Roofing Company, Eighteenth and Wood streets, Oakland, Cal., has been completely gutted by fire.

The Hollands Manufacturing Company, manufacturer of gas burners, Erie, Pa., is expected to erect a foundry next spring.

The A. Whitaker estate intends to put up a manufacturing building at Cedar Grove, Tabor road, west of Asylum road, Philadelphia, Pa.

The Horton Manufacturing Company, maker of brushes, is putting in the foundation for a new factory on Ash street, Reading, Mass.

The Brooklyn (N. Y.) Rapid Transit Company will at once rebuild the Ridgewood power-house, which was burned December 4.

It is stated that the Baltimore & Ohio officials contemplate enlarging the Cumberland (Md.) shops to twice their present capacity.

(*Continued on page* 53.)

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant ; see p. 24.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.Mach.T.Co.,Meriden,Ct.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

We want to build small tools for you ; price low ; write us. Box 92, AMER. MACHINIST.

New Book—"Oil Engines," Goldingham, $2. Spon & Chamberlain, 12 Cortlandt st., N. Y.

Light and fine mach'y to order ; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking." $1, post paid. J.L.Lucas,Bridgeport,Ct. Send for index sheet.

Selden Packing for Stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., New York.

For Sale—Unbound back volumes of the "American Machinist," from Volume 7. A. F. Ward, Newcomerstown, O.

F. J. Stokes Machine Co., 13th and Noble sts., Philadelphia, cut light gears, cams, and duplicate small machine parts, in quantities.

For Sale—Second-hand two-spindle centering machine ; cheap and in good condition. Binghamton Mach. Tool Works, Binghamton, N. Y.

Wanted—One second-hand universal milling Machine, of a size corresponding to 1, 1½ or 2 Brown & Sharpe. The F. Bissell Co., Toledo, Ohio.

Wanted—Machine shop well equipped for manufacturing special automatic machines ; contract can be secured amounting to $1,000 per month. Box 123, AMERICAN MACHINIST.

Parties familiar with machine tool manufacturing and $40,000 can secure controlling interest in stock company ; capacity 175 to 200 men. Address Box 122, AMER. MACHINIST.

Special machinery designed and built for the cheaper production of product ; machinery for screening, sizing, etc. ; experimental work at low cost. Beckley Perforated Metal Works, Garwood, N. J.

Wanted—30 in. or 32 in. lathe, 20 ft. between centers ; 3 ft. arm radial drill ; ½ in. to 2 in. bolt cutter ; keyseating machine ; 5 ton hand-power traveling crane, about 20 ft. span. Address Box 93, AMERICAN MACHINIST.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W. Detroit, Mich.

We are open to treat with a large engineering firm or syndicate in U. S. A. for the supply of a complete modern plant for making fuel economizers in U. S. A., the same as made in England ; we have had 30 years' experience in working and manufacturing fuel economizers of all types ; output in England about 300,000 pipes per annum ; inspection at our works if required. Apply Roberts Brothers, Fuel Economizers and Machine Tool Makers, Dukinfield, Manchester, England.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded ; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Experienced draftsman wants a position. Box 129, AMERICAN MACHINIST.

Tool, jig, die maker and foreman wants work. Box 110, AMERICAN MACHINIST.

Situation wanted by practical draftsman ; New York city. Box 131, AMER. MACHINIST.

Foreman pattern-maker, competent draftsman ; 15 years in charge. Box 133, A. MACH.

Experienced mechanical draftsman wants situation. Address "Details," care AM. MACH.

Technical graduate wishes position as mechanical draftsman. Address Box 140, A. M.

Machinist, 10 years on models and special machinery ; New York preferred. Box 135, AMERICAN MACHINIST.

Machinist, 20 years' experience, will take charge lathes, milling machines ; New York, Buffalo. Box 136, AMERICAN MACHINIST.

Expert designer automatic machinery ; shop experience and technical education ; New York or vicinity preferred. Box 104, AMER. MACH.

A young practical mechanical engineer, with extensive experience, wishes position with large manufacturing company. Box 26, A. M.

Detail draftsman and tracer, 11 years' experience, also expert machinery photographer, desires a change. Address Box 130, A. MACH.

Graduate mechanical engineer desires position ; 3 years' experience, steam plants, structural steel, conveyors and elevators. Box 117, AMERICAN MACHINIST.

Mechanical draftsman, graduate, wants position ; 12 years' experience in steam engines, blast furnaces, general machinery. Box 137, AMERICAN MACHINIST.

Draftsman, graduate, 12 years' experience in charge general machinery design and complete plants of machinery ; executive ability. Box 134, AMERICAN MACHINIST.

Mechanical draftsman, specialist on piping, heating and shafting, seeks permanent New York position ; references and specimens of work. Box 132, AMERICAN MACHINIST.

Foreman machinist wishes to change ; 12 years' experience ; up to date in modern methods, machine tools, special machines, engines and general work. Box 141, AMER. MACH.

Superintendent of engine-building factory wishes to change position ; thoroughly familiar with high-speed and Corliss engine design and manufacture. Address "Reliable," care AMERICAN MACHINIST.

First-class man wants position as office manager or accountant ; is experienced accountant, expert in modern shop cost system, good organizer and methodical. Address Williams, Box 119, AMERICAN MACHINIST.

Wanted—By an up-to-date foundryman, position as superintendent or foreman ; understand mixing and melting of irons, handling men in making dry-sand and green-sand castings. Address "Foundryman," care A. MACH.

A mechanical draftsman having years of experience, who can take pencil and paper and design Corliss engines or special machinery, who will also look after a few men and see work through the shop, desires a position with a good salary. Address Box 111, AM. M.

Wanted—Position as superintendent, to take entire charge of plant ; have good executive and mechanical ability ; can reorganize machine plant to best advantage ; am thoroughly informed on methods of cost-keeping, piece work and capable of handling large force of men ; well posted in general shop practice, tool-making, designing special tools, jigs, milling fixtures, and understand fully handling work on the interchangeable system ; at present with prominent concern. Address Box 128, AMERICAN MACHINIST.

Help Wanted.

Wanted—Three first-class die-makers, familiar with blanking, drawing and forming dies. Box 101, AMERICAN MACHINIST.

Wanted—Machine-tool and engine draftsman ; young man preferred ; state age and experience. Chandler & Taylor Co., Indianapolis, Ind.

Wanted—Competent foreman to take charge of toolroom on sheet-metal dies ; must have had experience as a foreman. Box 100, AMERICAN MACHINIST.

Wanted—First-class draftsman on switchboard work. Address, giving age, experience and reference, W. O. Wakefield, care General Electric Co., Schenectady, N. Y.

Flange Turner.—Wanted, at once, one first-class flange turner ; no strike ; steady work ; wages no object to the right man. Phoenix Iron Works Company, Meadville, Pa.

Wanted—Draftsman for engine-building establishment vicinity of Pittsburgh ; state age and experience and give references. Address Box 97, AMERICAN MACHINIST.

Wanted—Machine-shop foreman, with experience in building electrical machinery ; state experience, age and salary required ; East. Box 139, AMERICAN MACHINIST.

Wanted—Machinist gang foreman for erecting room ; must be capable of handling 15 to 20 men ; state age, experience and where obtained. Address Box 98, care AMER. MACH.

Wanted—To take charge of office in manufacturing business ; man familiar with shipping and time systems. Address, stating age and experience, Box 126, AMER. MACHINIST.

A first-class foreman for large, exclusive gas-engine shop ; 150 men ; must have experience in gas-engine work ; a cost reducer and systematizer. Box 124, AMERICAN MACHINIST.

We solicit correspondence from draftsmen, machinists, patternmakers and molders ; those familiar with engine or air-compressor work preferred. Address "Opportunity," care A. M.

Wanted—Superintendent for an established gear-cutting plant ; to one thoroughly familiar with gear cutting in all its branches a liberal salary will be paid. Address Box 127, AM. M.

Wanted—A draftsman familiar with the designing of heavy machine tools, a man competent to take charge of the drafting room. Apply at once to the Grant Tool Co., of Franklin, Pa.

Wish to engage the services of competent machine works foreman, capable of handling 150 mechanics to best advantage as to quality and quantity of output ; location, suburbs of Philadelphia. Address "Penn," care A. MACH.

We are enlarging our works, and will shortly require an increased number of skilled mechanics ; we invite application from pattern makers, molders and machinists. Address the Westinghouse Machine Company, East Pittsburgh, Pa.

Wanted—Foreman for machine department of shop manufacturing engines and air compressors ; none but those fully competent to handle men successfully and get the best results need apply ; state experience, age and salary expected. Address "Advancement," care AMERICAN MACHINIST.

Wanted—Superintendent of factory employing 30 to 50 hands in construction of steam specialties ; must have had experience in valve work and be up to date in modern shop practice ; permanent position to competent man ; state experience and salary expected. Address Box 96, AMERICAN MACHINIST.

Salesman Wanted—To sell a mechanical specialty of demonstrated value throughout Eastern and New England States ; must be a good theoretical and practical mechanic, as well as a salesman of broad experience ; iron-working machinery salesman preferred ; in making application, state reference and terms. Box 125, AMERICAN MACHINIST.

Wanted—Experienced, intelligent machine-shop foreman to take entire charge of machine shop employing 80 men on high-class heavy tool work and medium-sized special machinery ; will have assistant foreman ; good salary and future for capable man. Address Box 99, AMERICAN MACHINIST, stating age, experience, references and salary expected.